

XARIFIID COPEPODS (CYCLOPOIDA) PARASITIC IN CORALS IN MADAGASCAR

ARTHUR G. HUMES¹ AND JU-SHEY HO²

INTRODUCTION

The family Xarifiidae at present contains only the genus *Xarifia* Humes, 1960. (The genus *Kombia* Humes, 1962, assigned tentatively to this family, belongs more probably to the Lichomolgidae, as pointed out by Humes and Ho, 1968.) Two species, *X. maldivensis* and *X. fimbriata*, were described by Humes (1960) from corals in the Maldive Islands. Nine species are known from corals in the region of Nosy Bé, Madagascar. These are *X. gerlachi*, *X. longipes*, *X. dispar*, *X. reducta*, *X. serrata*, *X. tenuis*, *X. infrequens*, and *X. comata*, all described by Humes (1962), and *X. diminuta* Humes and Ho (1967). This paper deals with nine new species of *Xarifia* and two new species belonging to a new xarifiid genus, collected from corals in the vicinity of Nosy Bé during 1960 and 1963-64.

All collections were made by A. G. Humes, those in 1960 during an expedition of the Academy of Natural Sciences of Philadelphia, and those in 1963-64 as part of the U.S. Program in Biology of the International Indian Ocean Expedition. Type material has been deposited in the United States National Museum. Specimens of several of the new species have been placed in the Museum of Comparative Zoology.

¹ Boston University, Boston, Massachusetts.

² Associate in Marine Invertebrates, Museum of Comparative Zoology.

The study of the specimens has been aided by grants (GB-1809 and GB-5838) from the National Science Foundation of the United States.

All 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 it was drawn.

The measurement of the length of the body has been made in all cases from specimens in lactic acid and does not include the setae on the caudal rami. In the spine and setal formulas of legs 1-4 the Roman numerals indicate spines and the Arabic numerals represent setae.

The abbreviations used are: A₁ = first antenna, A₂ = second antenna, MD = mandible, P = paragnath, MX₁ = first maxilla, MX₂ = second maxilla, P₁ = leg 1.

We thank Dr. Donald F. Squires of the United States National Museum for the identifications of corals collected in 1960, and Dr. Michel Pichon, then at the Centre O.R.S.T.O.M. de Nosy Bé, for the determinations of those collected in 1963-64.

The new copepods described in this paper comprise the following:

- 1) *Xarifia lamellispinosa* n. sp.
from *Pachyseris speciosa* (Dana)
- 2) *Xarifia exigua* n. sp.
from *Pachyseris speciosa* (Dana)
- 3) *Xarifia decorata* n. sp.
from *Stylophora pistillata* (Esper)
and *Stylophora mordax* (Dana)

- 4) *Xarifia lissa* n. sp.
from *Stylophora pistillata* (Esper)
and *Stylophora mordax* (Dana)
- 5) *Xarifia obesa* n. sp.
from *Pocillopora verrucosa* (Ellis
and Solander), *Pocillopora* sp. cf.
P. verrucosa (E. and S.), and *Po-
cillopora danac* Verrill
- 6) *Xarifia brevicauda* n. sp.
from *Alveopora* sp.
- 7) *Xarifia tenuira* n. sp.
from *Montipora sinensis* Bernard
- 8) *Xarifia anomala* n. sp.
from *Acropora palifera* (Lamarck)
- 9) *Xarifia hamata* n. sp.
from *Turbinaria* sp.
- 10) *Orstomella faviae* n. gen., n. sp.
from *Favia* sp.
- 11) *Orstomella lobophylliae* n. gen., n.
sp.
from *Lobophyllia costata* (Dana)
and *Lobophyllia corymbosa* (For-
skål)

The following represent new host records:

- 1) *Xarifia dispar* Humes, 1962
from *Echinopora lamellosa* (Es-
per) and *Echinopora gemmacea*
(Lamarck)
- 2) *Xarifia serrata* Humes, 1962
from *Pocillopora bulbosa* Ehren-
berg

KEYS TO THE SPECIES OF THE GENUS *XARIFIA*

Females

- 1. Endopods of legs 1-4 one-segmented 2
- Endopods of legs 1-4 two-segmented 13
- 2. Region dorsal to fifth legs with two or
three processes 3
- Region dorsal to fifth legs without proces-
ses (or at most a median transverse
ridge as in *X. serrata*) 10
- 3. Region dorsal to fifth legs with two proces-
ses 4
- Region dorsal to fifth legs with three proces-
ses 5
- 4. Leg 5 with a small free segment (24×9
 μ); outer element on second segment of
exopods of legs 1-4 a seta rather than
a spine; body unusually stout, about 4
times longer than wide *obesa*
- Leg 5 without a free segment and repre-
sented only by three setae; second seg-
ment of exopods of legs 1-4 outwardly
unarmed; body elongated and slender,
6.7 times longer than wide *finbriata*
- 5. Three processes above fifth legs about
equal in length 6
- Two lateral processes distinctly shorter
than median process 9
- 6. Processes short; caudal ramus small and
indistinctly set off from anal segment *gerlachi*
- Processes elongated; caudal ramus distinctly
set off from anal segment 7
- 7. Two small lobes between processes; outer
element on second segment of exopod
of legs 1-4 a seta *maldivensis*
- Without knobs between processes; outer
element on second segment of exopod
of legs 1-4 a spine 8
- 8. Three processes about equal in length;
length of body 0.75 mm *exigua*
- Middle process a little shorter than other
two; length of body 1.48 mm *longipes*
- 9. Caudal ramus about 9 times longer than
wide; first segment of exopod of legs
1-4 without an outer spine, but instead
only a minute spiniform projection *tenuis*
- Caudal ramus about 4 times longer than
wide; first segment of exopod of legs
1-4 with a distinct (though small) spine
..... *infrequens*
- 10. Body about 10 times longer than wide;
caudal ramus fused with anal segment;
postgenital segments fused into a single
small segment *tenuira*
- Body about 6-7 times longer than wide;
caudal ramus distinct; postgenital seg-
ments not unusually reduced 11
- 11. Second segment of exopods of legs 1-4
with only a small outer knob; region
dorsal to fifth legs not projected *reducta*
- Second segment of exopods of legs 1-4
unarmed; region dorsal to fifth legs pro-
jected to form a slight transverse ridge 12
- 12. Leg 5 122 μ long; blade of mandible with
small spinules; endopod of leg 2 with
two terminal setae *serrata*
- Leg 5 72 μ long; blade of mandible with
strong teeth; endopod of leg 2 with
three terminal setae *lissa*
- 13. Second segment of exopod of legs 1-4
unarmed *comata*
- Second segment of exopod of legs 1-4
with either a spine or a seta 14
- 14. First and second segments of exopods of
legs 1-4 similarly armed with a slender
outer spine (almost setiform) *dispar*
- These segments not so armed 15

- | | |
|---|---|
| <p>15. First and second segments of exopods of legs 1-4 with a strong outer spine 16
These segments not so armed (second segment with a small outer spine or a seta) 19</p> <p>16. Endopod of leg 3 with a terminal seta; length of body 1.90 mm — <i>lamellispinosa</i>
Endopod of leg 3 unarmed; length of body 1.27 mm or less 17</p> <p>17. Endopod of leg 1 unarmed; endopod of leg 2 with three terminal setae — <i>anomala</i>
Endopods of legs 1 and 2 with two terminal setae 18</p> <p>18. Endopod of leg 4 with two terminal setae; length of body 0.98 mm — <i>diminuta</i>
Endopod of leg 4 unarmed; length of body 1.27 mm — <i>brevicauda</i></p> <p>19. First segment of exopods of legs 1-4 with a strong outer spine; second segment of exopod of leg 1 with a small outer spine, in legs 2-4 with a seta; endopods of legs 1-4 with terminal setae — <i>decorata</i>
First segment of exopods of legs 1-4 with a strong outer spine; second segment of these exopods with a seta; endopod of leg 2 with a seta and a clawlike spine, endopods of legs 3 and 4 with only a clawlike spine — <i>hamata</i></p> | <p>7. Body unusually stout, about 4 times longer than wide — <i>obesa</i>
Body more slender, a little more than 6 times longer than wide — <i>maldicensis</i></p> <p>8. First segment of exopod of leg 1 without a distinct element, having only a minute outer process — <i>tennis</i>
First segment of exopod of leg 1 with a distinct outer element 9</p> <p>9. First segment of exopod of leg 1 with an outer spine 10
First segment of exopod of leg 1 with an outer seta — <i>fimbriata</i></p> <p>10. Second segment of exopod of leg 1 with a small outer knob or hyaline seta 11
Second segment of exopod of leg 1 unarmed 12</p> <p>11. Second segment of exopod of leg 1 with a small outer knob; concave surface of claw of maxilliped with a row of about twelve long spinules — <i>reducta</i>
Second segment of exopod of leg 1 with a small hyaline seta; concave surface of claw of maxilliped serrated — <i>lissa</i></p> <p>12. Concave margin of claw of maxilliped with irregular rounded serrations; body about 8 times longer than wide — <i>serrata</i>
Concave margin of claw of maxilliped distally with a few minute teeth; body about 11 times longer than wide — <i>infrequens</i></p> |
|---|---|

Males

- | | |
|---|--|
| <p>1. Endopods of legs 1-4 one-segmented 2
Endopods of legs 1-4 two-segmented 13</p> <p>2. First and second segments of exopod of leg 1 with a distinct outer spine 3
Both of these segments or only second segment lacking such a spine 6</p> <p>3. Caudal ramus small and completely or partially fused with anal segment 4
Caudal ramus more prominent and distinct from anal segment 5</p> <p>4. Body about 7 times longer than wide; blade of mandible with spinules; second segment of exopods of legs 2-4 with an outer spine — <i>gerlachi</i>
Body about 10 times longer than wide; blade of mandible smooth; second segment of exopods of legs 2-4 unarmed — <i>tennura</i></p> <p>5. Terminal setae on endopods of legs 1-4 arranged as 2, 1, 1, 1; length of body, 1.43 mm — <i>longipes</i>
Terminal setae on endopods of legs 1-4 arranged as 2, 2, 1, 1; length of body 0.80 mm — <i>exigua</i></p> <p>6. Second segment of exopod of leg 1 with an outer seta 7
Second segment of exopod of leg 1 unarmed (or at most with only a small outer knob as in <i>X. reducta</i>) 8</p> | <p>13. Second segment of exopods of legs 1-4 unarmed — <i>comata</i>
Second segment of exopods of legs 1-4 with a spine or seta 14</p> <p>14. Second segment of exopods of legs 1-4 with an outer seta; second segment of endopod of leg 2 with a seta and a clawlike spine — <i>hamata</i>
Second segment of exopod of leg 1 with an outer spine; without a clawlike spine on second segment of endopod of leg 2 15</p> <p>15. Second segment of exopods of legs 2-4 with an outer seta — <i>decorata</i>
Second segment of exopods of legs 2-4 with an outer spine 16</p> <p>16. Spines on first two segments of exopods of legs 1-4 slender, almost setiform — <i>dispar</i>
Spines on these segments clearly spiniform rather than setiform 17</p> <p>17. With a terminal seta on endopod of leg 3, formula for terminal elements on endopods of legs 1-4 being 2, 2, 1, 1 — <i>lamellispinosa</i>
Without a terminal seta on endopod of leg 3 18</p> <p>18. Without terminal setae on endopod of leg 1, formula for terminal elements of endopods of legs 1-4 being 0, 3, 0, 0 — <i>anomala</i></p> |
|---|--|

- With two terminal setae on endopod of leg 1
19. Without terminal setae on endopod of leg 4, formula for terminal elements on endopods of legs 1-4 being 2, 2, 0, 0; postgenital region shortened with segments fused; concave margin of claw of maxilliped with a serrated excrescence *brevicauda*
- With two terminal setae on endopod of leg 4, formula for terminal elements on endopods of legs 1-4 being 2, 2, 0, 2; postgenital region not shortened; concave margin of claw of maxilliped without a serrated excrescence *diminuta*

SYSTEMATIC DESCRIPTION

XARIFIIDAE Humes, 1960

XARIFIA Humes, 1960

Xarifia lamellispinosa n. sp.

Figs. 1-22

Type material.—13 females and 14 males from a colony of *Pachyseris speciosa* (Dana) in a depth of 2 m, Ambariotsimaramara, off Ampombilava, Nosy Bé, Madagascar. Collected June 12, 1964. Holotype female, allotype, and 21 paratypes (10 females and 11 males) deposited in the United States National Museum, Washington; the remaining paratypes (dissected) in the collection of A. G. Humes.

Other specimens (all from *Pachyseris speciosa*).—3 females and 11 males in 3 m, Pte. Ambarionaomby, Nosy Komba, near Nosy Bé, September 3, 1963; 1 male in 2 m, Ambariotsimaramara, off Ampombilava, Nosy Bé, October 18, 1963.

Female.—Body (Figs. 1 and 2) slender, about 7 times longer than wide. Length 1.90 mm (1.84-2.00 mm) and greatest width 0.27 mm (0.26-0.27 mm), based on 10 specimens. Segmentation not well defined externally. Region dorsal to fifth legs bearing three long posteriorly directed processes, the median one slightly shorter than the lateral ones. Genital and postgenital segments together a little less than one-fourth of total body length. Areas of attachment of egg sacs located dorsally (Fig. 3). Caudal ramus (Fig. 4) about $51 \times 28 \mu$

in greatest dimensions, a little less than 2 times longer than wide; with four short naked setae (one outer and subterminal, the others terminal) and surficial hairs. Egg sac (Fig. 3) 340μ in length, containing five eggs (except in one female where the sac on one side had only four), each egg about 109μ in average diameter.

Rostral area a rounded lobe between bases of first antennae and covered with short hairs (Fig. 5). First antenna (Fig. 6) short (about 60μ in length without setae) and apparently 3-segmented. With numerous naked setae, the armature being 3, 22 + 1 aesthete, and 9 + 2 aesthetes. Second antenna (Fig. 7) 4-segmented, the formula being 1, 1, 2, and 1, 1. Recurved claw and seta on last segment both 17μ long.

Labrum (Fig. 8) with trilobate free margin, the middle lobe slightly indented. Mandible (Fig. 9) with blade having four teeth and a recurved tip. Paragnath absent. First maxilla (Fig. 10) a small lobe with two naked setae. Second maxilla (Fig. 11) probably 2-segmented, second segment bearing two unequal inner setae and a distal lamellate expansion with a terminal knob. Maxilliped (Fig. 12) apparently 3-segmented, first segment with an outer lobate expansion, second segment bearing two inner setae and a lobate expansion, third segment with two small spiniform elements and terminating in a short claw. Relationships of head appendages as in Figure 13.

Legs 2-4 with general form and segmentation like that of leg 1 (Fig. 14), exopods 3-segmented, endopods 2-segmented. Spine and setal formula as follows:

P_1 protopod 0-0; 1-0 exp 1-0; 1-0; 1, 3
end 0-0; 2

P_2 protopod 0-0; 1-0 exp 1-0; 1-0; 1, 2
end 0-0; 2

P_3 and P_4 protopod 0-0; 1-0 exp 1-0; 1-0; 1, 2
end 0-0; 1

In all four legs posterior surface of protopod with a patch of hairs and basis with an outer naked seta. Exopods with stout spines recurved posteriorly and bearing

conspicuous lamellae (Figs. 14, 15, and 16); three slender setae at inner base of terminal spine in leg 1, two such setae in legs 2, 3, and 4. Endopods with few hairs on outer margins of both segments, and with two terminal setae in legs 1 and 2 but only one such seta in legs 3 and 4. Leg 4 (not drawn) armed as in leg 3. Intercoxal plate V-shaped in leg 1, less so in succeeding legs.

Leg 5 (Fig. 17) elongated and slender, with its free segment not clearly delimited from body. Segment about $110\ \mu$ in length and tapered distally, with two unequal terminal naked setae 11 and $37\ \mu$ long. A slender seta arising from body wall dorsal to base of segment. Leg 6 absent.

Color in life in transmitted light slightly brownish, eye red.

Male.—Body (Figs. 18 and 19) slender, almost as long as female. Length 1.83 mm (1.76–1.87 mm) and greatest width 0.22 mm (0.19–0.24 mm), based on 10 specimens. Without external segmentation. Caudal ramus about $34 \times 25\ \mu$, weakly set off from anal segment (Fig. 20).

Rostral area as in female. First antenna like that of female, but with four aesthetes, one being added on midanterior margin of middle segment. Second antenna, labrum, mandible, first maxilla, and second maxilla resembling those in female. Paragnath absent. Maxilliped (Fig. 21) 4-segmented. First segment short and unarmed. Second large and swollen with two inner setae. Third very short and unarmed. Fourth segment forming a terminal claw $57\ \mu$ along its axis, with a prominent conical process on its inner concave margin and trifurcated at its tip, bearing two proximal unequal setae (one sclerotized basally but hyaline and obtuse distally, the other hyaline throughout).

Legs 1–4 as in female, with same spine and setal formula. Leg 5 (Fig. 22) having its small free segment ($12 \times 8\ \mu$) not distinctly delimited from body and bearing two unequal terminal naked setae 14 and $31\ \mu$ long. Leg 6 (Fig. 20) represented by

a posteroventral flap on genital segment bearing two small setae.

Spermatophore not observed.

Color as in female.

Etymology.—The specific name *lamellispinosa* is a combination of the Latin words *lamella* = a lamella, and *spinosisus* = having spines, in allusion to the conspicuous lamellae on the spines of the exopods of legs 1–4.

Comparison with related species.—Only three of the eleven known species in the genus *Xarifia* resemble the new species in having three long processes dorsal to the fifth legs in the female, in having an elongated leg 5 in the female, and in having 2-segmented endopods in legs 1–4. These are *X. dispar* Humes, 1962, *X. comata* Humes, 1962, and *X. diminuta* Humes and Ho, 1967. From each of these *X. lamellispinosa* may be readily distinguished. *X. dispar* has a slender, almost straight spine instead of a stout recurved spine on the first and second segments of the exopods of legs 1–4. *X. comata* lacks a spine on the second segment of these legs, and has two terminal setae on the endopod of leg 3. *X. diminuta* lacks setae on this endopod, and the mandible has a smooth blade without teeth. Furthermore, *X. lamellispinosa* is considerably larger than these three species, with its size range not overlapping any of them.

Xarifia exigua n. sp.

Figs. 23–43

Type material.—21 females and 28 males from a colony of *Pachyseris speciosa* (Dana) in a depth of 2 m, Ambariotsimaramara, off Ampombilava, Nosy Bé, Madagascar. Collected October 18, 1963. (One male of *X. lamellispinosa* also was washed from this colony.) Holotype female, allotype, and 39 paratypes (16 females and 23 males) deposited in the United States National Museum; the remaining paratypes in the collection of A. G. Humes.

Female.—Body (Figs. 23 and 24) slender, about 7.5 times longer than wide.

Length 0.75 mm (0.71–0.80 mm) and greatest width 0.10 mm (0.10–0.11 mm), based on 10 specimens. External segmentation not well defined. Region dorsal to fifth legs bearing three long posteriorly directed processes of about equal length. Genital and postgenital segments together about one-fourth of total body length. Areas of attachment of egg sacs situated dorsally (Fig. 25). Caudal ramus (Fig. 26) $41 \times 11 \mu$, about 4 times longer than wide, with the usual four setae, all relatively long and slender. Egg sac unknown.

Rostral area rounded (Fig. 27). First antenna (Fig. 27) short, about 50μ in length, and apparently 3-segmented. Armature: 3, 22 + 1 aesthete, and 9 + 2 aesthetes, all setae hyaline and naked. Second antenna (Fig. 28) 4-segmented, with formula same as in previous species. Slender claw and adjacent seta on last segment both 18μ long.

Labrum (Fig. 29) with trilobate free margin, slightly indented medially. Mandible (Fig. 30) with smooth pointed blade. Paragnath absent. First maxilla (Fig. 31) the usual small lobe with two naked setae. Second maxilla (Fig. 32) 2-segmented, resembling that of *X. diminuta*, second segment having two unequal inner setae and a terminal lamellate process. Maxilliped (Fig. 33) probably 3-segmented, but segmentation obscure. Region of second segment with two inner setae and a lobate expansion; that of third segment with two minute elements and lacking a claw. Relationships of head appendages as in Figure 34.

Legs 2–4 with general form and segmentation as in leg 1 (Fig. 35), exopods 3-segmented, endopods 2-segmented. Spine and setal formula as follows:

P_1 and P_2 protopod 0–0; 1–0 exp 1–0; 1–0; 1, 2
end 2
 P_3 and P_4 protopod 0–0; 1–0 exp 1–0; 1–0; 1, 2
end 1

In all four legs, basis with an outer naked seta. Exopod spines rather long and slender, not strongly recurved. Small spini-

form process near base of spine on first exopod segment. Endopods consisting of a single segment provided on outer margin with a proximal setule followed by a row of hairs. Endopods of legs 1 and 2 with two terminal setae, those of legs 3 (Fig. 36) and 4 with a single such seta. Intercoxal plate of leg 1 rather wide (Fig. 35), those of succeeding legs narrower.

Leg 5 (Fig. 37) elongated and slender, with free segment weakly delimited from body. Segment about 100μ long and tapered distally, the two terminal setae 13 and 24μ in length. Leg 6 absent.

Color in life in transmitted light pale brownish, eye red.

Male.—Body (Figs. 38 and 39) slender, about as long as female. Length 0.80 mm (0.76–0.85 mm) and greatest width 0.10 mm (0.10–0.10 mm), based on 10 specimens. Without external segmentation. Caudal ramus (Fig. 40) smaller than in female, $19 \times 10 \mu$.

Rostral area as in female. First antenna resembling that of female, but with an additional aesthete on second segment. Second antenna, labrum, mandible, first maxilla, and second maxilla like those in female. Paragnath absent. Maxilliped (Fig. 41) segmented and armed as in previous species. Second segment with two inner setae. Fourth segment forming a claw 31μ along its axis, with a conical process on its inner concave margin and bifurcated at its tip (in one male trifurcated on one maxilliped), bearing the usual two unequal proximal setae.

Legs 1–4 as in female, with same spine and setal formula. Leg 5 (Fig. 42) with a small segment not well delimited from body and bearing two unequal setae. Leg 6 (Fig. 43) the usual posteroventral flap on genital segment with two setae.

Spermatophore not observed.

Color as in female.

Etymology.—The specific name *exigua*, from Latin = small in size, refers to the small size of this species, the smallest of any species of *Xarifia* thus far described.

Comparison with related species.—There are eight known species of *Xarifia* in which the endopods of legs 1–4 are 1-segmented, thus resembling *X. exigua*. These are *X. maldivensis* Humes, 1960, *X. fimbriata* Humes, 1960, *X. gerlachi* Humes, 1962, *X. longipes* Humes, 1962, *X. reducta* Humes, 1962, *X. serrata* Humes, 1962, *X. tenuis* Humes, 1962, and *X. infrequens* Humes, 1962. In only two of these, *X. gerlachi* and *X. longipes*, does the second exopod segment of legs 1–4 bear a spine, as in the new species; in the others there may be a seta, a small knob, or no element at all. *X. exigua* may be readily distinguished from *X. gerlachi* which has three short processes above the fifth legs in the female and a larger size (female 2.04 mm, male 0.89 mm), and from *X. longipes* which has three very long processes (the middle one slightly shorter than the others) dorsal to the fifth legs in the female, relatively very long caudal rami, and a larger size (female 1.48 mm, male 1.43 mm).

Xarifia decorata n. sp.

Figs. 44–69

Type material.—30 females and 22 males from several colonies of *Stylophora pistillata* (Esper) in a depth of 0.5 m, Navetsy, Nosy Bé, Madagascar. Collected September 24, 1964. Holotype female, allotype, and 38 paratypes (22 females and 16 males) deposited in the United States National Museum; the remaining paratypes in the collection of A. G. Humes.

Other specimens.—From *Stylophora pistillata*: 19 females and 14 males in 0.5 m, Ambariobe, a small island nearly between Nosy Komba and Nosy Bé, August 4, 1963; 14 females and 12 males in 3 m, Ambariobe, August 13, 1963; 5 females and 10 males in 0.5 m, Ambariobe, October 6, 1963; and 1 male in 0.5 m, west of Pte. Mahatsinjo, Nosy Bé, January 31, 1964. From *Stylophora mordax* (Dana): 4 females in 2 m, Pte. Ambarionaomby, Nosy Komba, October 1, 1963.

Female.—Body (Figs. 44 and 45) slender, about 6.8 times longer than wide. Length 1.49 mm (1.45–1.53 mm) and greatest width 0.22 mm (0.21–0.22 mm), based on 10 specimens. External segmentation poorly defined. Region dorsal to fifth legs bearing three long slender posteriorly directed processes (Fig. 46) of about equal length (220 μ). (In one female carrying a spermatophore these processes were shorter, about 165 μ , and not as slender.) Genital and postgenital segments together a little less than one-fourth of total body length. Areas of attachment of egg sacs located dorsally. Caudal ramus (Fig. 47) elongated, $88 \times 19 \mu$, about 4.6 times longer than wide, and arched dorsally as in Figure 46; bearing one outer subterminal seta and four terminal setae, all relatively short and naked. Egg sac (Fig. 45) containing 2, 3, or 4 eggs in a row, each egg about $122 \times 166 \mu$. Surface of body covered with fine setules as in Figure 46.

Rostral area (Fig. 48) forming a tongue-shaped lobe bearing setules between bases of antennae and projecting a little beyond anterior margin of head in dorsal view (Fig. 49). First antenna (Fig. 50) short, about 54 μ , and apparently 3-segmented, though second and third segments show partial division. Armature: 3, 22 + 1 aesthete, and 9 + 2 aesthetes, all setae hyaline and naked. Second antenna (Fig. 51) 4-segmented and armed as in two previous species. Terminal claw very slender, 13 μ long, and seta adjacent to it 18 μ .

Labrum (Fig. 52) not trilobed, but indented medially. Mandible (Fig. 53) with smooth pointed blade. Paragnath absent. First maxilla (Fig. 54) the usual small lobe with two naked setae. Second maxilla (Fig. 55) 2-segmented, second segment bearing two unequal hyaline setae and projected terminally to form a broad lamellate lobe with hyaline margins. Maxilliped (Fig. 56) with obscure segmentation, region of second segment bearing two small inner setae and two lobate expansions, that of third segment forming two spinelike processes.

Relationships of head appendages as in Figure 57.

Legs 2-4 with general form and segmentation as in leg 1 (Fig. 58), exopods 3-segmented, endopods 2-segmented. Spine and setal formula as follows:

P_1 protopod	0-0; 1-0	exp	1-0; 1-0; 1, 3
		end	0-0; 3
P_2 protopod	0-0; 1-0	exp	1-0; 1-0; 1, 2
		end	0-0; 3
P_3 and P_4 protopod	0-0; 1-0	exp	1-0; 1-0; 1, 2
		end	0-0; 1

In all four legs, basis with an outer naked seta and inner group of long setules. Second segment of exopod of leg 1 with a small outer spine; in legs 2 (Fig. 59), 3, and 4 this spine replaced by a small hyaline seta. Inner margins of exopod segments with long hairlike setules. Endopods of all four legs with similar setules on both margins of first segment and on outer margin of second segment. Legs 1 (Fig. 58) and 2 with three terminal setae on endopod; legs 3 (Fig. 60) and 4 with a single such seta. Intercostal plate of leg 1 narrow and U-shaped (Fig. 58), those of succeeding legs much narrower and V-shaped.

Leg 5 (Fig. 61) elongated and tapered distally, the free segment about 150 μ long and fused with body, the two terminal setae 35 and 37 μ in length. Leg 6 absent.

Color in life in transmitted light opaque, intestine reddish brown, eye red.

Male.—Body (Figs. 62 and 63) slender, a little shorter than female. Length 1.27 mm (1.25-1.28 mm) and greatest width 0.17 mm (0.16-0.17 mm), based on 10 specimens. Only slight indication of external segmentation. Caudal ramus (Fig. 64) much shorter than that of female, 24 \times 14 μ . Body surface with fewer and less conspicuous setules than in female.

Rostral area like that of female. First antenna similar to that of female, but with an additional aesthete on second segment. Second antenna as in female. Labrum (Fig. 65) resembling that of female, but with outer corners projected. Mandible, first maxilla, and second maxilla like those of female. Paragnath absent. Maxilliped (Fig.

66) segmented and armed as in two previous species. Second segment with two inner setae. Fourth segment forming proximal part of claw and bearing two unequal setae. Claw 67 μ along its axis, showing a line of partial division about midway; its inner concave margin with a row of dentiform spinules and its tip bifurcated.

Legs 1-4 as in female, with same spine and setal formula. Leg 5 (Fig. 67) reduced to a slight ridge bearing two setae 22 and 24 μ in length, with a third seta arising from the body nearby. Leg 6 (Fig. 68) the usual posteroventral flap on genital segment with two setae.

Spermatophore (Fig. 69), attached to female, elongated, 277 \times 55 μ , not including the short neck.

Color as in female.

Etymology.—The specific name *decorata*, from Latin = decorated, alludes to the many setules on the body surface and on legs 1-4.

Comparison with related species.—Like *X. dispar* Humes, 1962, *X. comata* Humes, 1962, *X. diminuta* Humes and Ho, 1967, and *X. lamellispinosa*, *X. decorata* has 2-segmented endopods in legs 1-4. The new species may, however, be readily distinguished from each of these four species by the nature of the outer elements on the first and second segments of the exopods of legs 1-4. These segments in *X. dispar* bear a slender spine. In *X. comata* the first segment has a minute spine and the second is unarmed. In *X. diminuta* and *X. lamellispinosa* both segments bear a well developed stout spine. Furthermore, in none of the four species does the claw of the male maxilliped have an inner row of dentiform spinules, as in the new species.

Xarifia lissa n. sp.

Figs. 70-90

Type material.—9 females and 12 males from *Stylophora pistillata* (Esper) in depth of 0.5 m, Ambariobe, a small island nearly between Nosy Komba and Nosy Bé, Madagascar. Collected August 4, 1963. (Nine-

teen females and 14 males of *X. decorata* were also recovered from this colony.) Holotype female, allotype, and 15 paratypes (6 females and 9 males) deposited in the United States National Museum; the remaining paratypes (dissected) in the collection of A. G. Humes.

Other specimens.—From *Stylophora pistillata*: 2 females and 1 male in 3 m. Ambariobe, August 13, 1963; 7 females and 6 males in 0.5 m. Ambariobe, October 6, 1963. From *Stylophora mordax* (Dana): 2 females and 1 male in 2 m, Pte. Ambarionaomby, Nosy Komba, October 1, 1963.

Female.—Body (Figs. 70 and 71) moderately slender, about 6 times longer than wide. Length 1.40 mm (1.36–1.50 mm) and greatest width 0.23 mm (0.20–0.25 mm), based on 7 specimens. External segmentation weakly defined. Region dorsal to fifth legs smooth, without processes, in lateral view (Fig. 72) raised dorsally. Genital and postgenital segments together about one-fifth of total body length. Areas of attachment of egg sacs located dorsolaterally (Fig. 72). Caudal ramus (Fig. 73) moderately elongated, $41 \times 19 \mu$ (width taken at middle), about twice as long as wide; armed with a subterminal outer seta and four terminal setae, one of them very short. Egg sac (Fig. 71) containing 2 or 3 eggs in a row, eggs somewhat variable in size, distalmost egg in figure $174 \times 104 \mu$. Surface of body with scattered short hairs.

Rostral area as in *X. decorata*. First antenna (Fig. 74) 3-segmented and short, about 45μ in length. Armature: 3, 18 + 1 aesthete, and 6 + 2 aesthetes, all setae hyaline and naked. Second antenna (Fig. 75) 4-segmented and armed as in three previous species. Terminal claw relatively short, 8μ , and adjacent seta long, 25μ .

Labrum (Fig. 76) trilobed, the middle lobe much expanded and not indented medially. Mandible (Fig. 77) with its blade having three relatively large inner teeth, two smaller outer teeth, and a recurved tip. Paragnath absent. First maxilla (Fig. 78) a small lobe with two setae.

Second maxilla (Fig. 79) 2-segmented, second segment bearing two unequal elements but lacking a lamellate process. Maxilliped (Fig. 80) probably 3-segmented, but segmentation obscure. Region of second segment bearing two small setae, that of third segment unarmed except for a conical terminal process. Relationships of head appendages as in Figure 81.

Legs 2–4 with general form and segmentation as in leg 1 (Fig. 82), exopods 3-segmented, endopods 1-segmented. Spine and setal formula as follows:

P_1 and P_2 protopod	0-0; 1-0	exp	1-0; 0-0; 1, 2
		end	3
P_3 and P_4 protopod	0-0; 1-0	exp	1-0; 0-0; 1, 2
		end	1

In all four legs, basis with an outer naked seta and an inner group of small setules. Second segment of exopods unarmed (Fig. 82). Endopods of legs 1 and 2 with three terminal setae, endopod of legs 3 (Fig. 83) and 4 with a single such seta. Intercostal plates in all four legs very narrow and V-shaped.

Leg 5 (Fig. 84) moderately elongated and tapered distally, the free segment partially fused with body and about 72μ in length. Two terminal setae offset on end of leg, unequal, 24 and 35μ long. Seta on body near free segment short. Leg 6 absent.

Color in life in transmitted light opaque, intestine reddish brown, eye red.

Male.—Body (Figs. 85 and 86) elongated and slender, only a little shorter than female. Length 1.32 mm (1.24–1.40 mm) and greatest width 0.16 mm (0.15–0.16 mm), based on 10 specimens. External segmentation weakly developed. Caudal ramus similar to that of female but smaller, $34 \times 14 \mu$. Body surface with fewer small hairs than in female.

Rostral area like that of female. First antenna (Fig. 87) resembling that of female, but an aesthete added on second segment. Second antenna, labrum, mandible, first maxilla, and second maxilla as in female. Paragnath absent. Maxilliped (Fig.

88) segmented and armed as in three previous species. Second segment with two inner setae. Fourth segment forming proximal part of claw, bearing two unequal setae. Claw 63μ along its axis, with its inner concave margin serrated and its tip bifurcated.

Legs 1-4 segmented as in female. Armature as in female except for second exopod segment of leg 1 where there is a small outer hyaline seta (Fig. 89). This seta absent on legs 2-4.

Leg 5 reduced to 3 setae as in *X. decorata*, without a free segment. Leg 6 (Fig. 90) the usual posteroventral flap on genital segment with two setae.

Spermatophore (seen only inside male, as in Figure 86) elongated.

Color in life as in female.

Etymology.—The specific name *lissa*, from the Greek word λισσός = smooth or bare, refers to the absence of processes on the region dorsal to the fifth legs in the female.

Comparison with related species.—Only two other described species of *Xarifia* lack processes on the region dorsal to the fifth legs in the female. These are *X. reducta* Humes, 1962, and *X. serrata* Humes, 1962. *X. reducta* is smaller (female 1.06 mm, male 0.91 mm), the second exopod segment of legs 1-4 bears a small knob, and the male maxilliped is slender, with the claw bearing a row of dentiform spinules. *X. serrata* has a relatively longer leg 5 in the female, the blade of the mandible bears several small spinules, the maxilliped of the female bears on the third segment a terminal seta and an elongated blunt process and a minute subterminal process, the claw of the male maxilliped has larger serrations, and the second exopod segment of leg 1 in the male is unarmed. The new species thus appears to be close to *X. serrata*, but differs from it in the several respects mentioned.

Xarifia obesa n. sp.

Figs. 91-113

Type material.—8 females and 10 males

from *Pocillopora verrucosa* (Ellis and Solander) in 2 m, west of Pte. Mahatsinjo, Nosy Bé, Madagascar. Collected November 2, 1960. (*X. comata* Humes and *X. serrata* Humes were also collected from this colony of coral.) Holotype female, allotype, and 12 paratypes (5 females and 7 males) deposited in the United States National Museum; the remaining paratypes in the collection of A. G. Humes.

Other specimens.—From *Pocillopora verrucosa*: 1 female, 2 males, and 1 immature specimen in 2 m, Pte. Mahatsinjo, October 26, 1960. From *Pocillopora* sp. cf. *P. verrucosa*: 9 females, 7 males, and 2 immature specimens in 2 m, west of Pte. Mahatsinjo, October 18, 1960. From *Pocillopora danae* Verrill: 3 females, 2 males, and 1 immature specimen in 6 m, Tany Kely, a small island to the south of Nosy Bé, December 28, 1963.

Female.—Body (Figs. 91 and 92) stouter than in other species of *Xarifia*, about 4 times longer than wide. Length 1.34 mm (1.21-1.48 mm) and greatest width 0.34 mm (0.29-0.35 mm), based on 8 specimens. External segmentation indicated by slight swellings. Region dorsal to fifth legs on each side with a posteriorly directed process. Genital and postgenital segments together about one-third of total body length. Areas of attachment of egg sacs located dorsolaterally (Fig. 93). Egg sac (Fig. 94) about $300 \times 240 \mu$, containing seven eggs in a cluster, each egg about 130μ in diameter. Caudal ramus (Fig. 95) about 70μ long and fused with body, rather pointed, with its small spherical tip set off from the proximal part. Armed with an outer marginal seta and three terminal setae, all naked. Body surface with a few small hairs.

Rostral area (Fig. 96) somewhat quadrate, with broadly rounded posterior margin. First antenna (Fig. 97) 3-segmented and short, about 40μ in length. Armature: 3, 17 + 1 aesthete, and 4 + 2 aesthetes, all setae hyaline and naked. Second antenna (Fig. 98) 3-segmented, the last two seg-

ments being fused. Armature as in previous four species; terminal claw strongly recurved, about 20 μ along its axis, and adjacent seta 16 μ .

Labrum (Fig. 99) with projected corners. Mandible (Fig. 100) with two rows of spinules on blade. Paragnath not seen. First maxilla (Fig. 101) a small lobe with two unequal naked setae. Second maxilla (Fig. 102) globose and highly modified, without definite segmentation, the region of second segment indicated by a pair of small setae and a more distal seta and minute process. Maxilliped (Fig. 103) probably 3-segmented, with two small setae on region of second segment, and two processes and a small seta on third segment. Relationships of head appendages as in Figure 104.

Legs 2-4 with general form and segmentation as in leg 1 (Fig. 105), exopods 3-segmented, endopods 1-segmented. Spine and setal formula as follows:

P_1 and P_2 protopod	0-0: 1-0	exp	1-0: 1-0: I, 2
			end 3
P_3 and P_4 protopod	0-0: 1-0	exp	1-0: 1-0: I, 2
			end 1

In all four legs, basis with an outer seta. Second segment of exopods with a small hyaline seta instead of a recurved spine, as in Figure 105. Endopods of legs 1 (Fig. 105) and 2 with three terminal setae, endopods of legs 3 (Fig. 106) and 4 with a single such seta. Interoxal plate of leg 1 wide and not indented, those of succeeding legs narrower.

Leg 5 (Fig. 107) relatively small (cf. Figs. 91 and 93), about $24 \times 9 \mu$ (width taken at middle), with two terminal setae 18 and 22 μ long. Leg 6 absent.

Color in life in transmitted light opaque, intestine greenish with red globules, eye red, egg sacs tinged with red.

Male.—Body (Figs. 108 and 109) stouter than in other species, approximately 4 times longer than wide, and only a little shorter than female. Length 1.21 mm (1.14-1.30 mm) and greatest width 0.29 mm (0.26-0.31 mm), based on 10 specimens. Ex-

ternal segmentation weakly developed. Caudal ramus similar to that of female but shorter, 55 μ in length.

Rostral area as in female. First antenna like that of female, but an additional aesthete on second segment. Second antenna, labrum, mandible, first maxilla, and second maxilla as in female. Paragnath not seen. Maxilliped (Fig. 110) segmented and armed as in four previous species. Second segment with two inner setae. Fourth segment forming proximal part of claw, bearing two setae, one proximal and the other near middle of concave margin. Distal part of this margin slightly serrated and tip of claw minutely trifurcated.

Legs 1-4 segmented and armed as in female. Leg 5 (Fig. 111) reduced to a small lobe with two terminal setae and an adjacent seta arising from body. Leg 6 (Figs. 112 and 113) the usual posteroventral flap on genital segment with two setae.

Spermatophore (seen only inside male, as in Figure 109) elongated.

Color in life as in female.

Etymology.—The specific name *obesa*, from Latin = fat or swollen, alludes to the unusually stout body.

Comparison with related species.—*X. fimbriata* Humes, 1960, is the only other species of *Xarifia* which has in the female two long processes dorsal to the fifth legs. This species may be easily separated from *X. obesa*, however, by its fifth legs which lack a distinct segment. From all species in the genus *X. obesa* may be distinguished by its stout body and the unique form of its caudal ramus.

Xarifia brevicauda n. sp.

Figs. 114-132

Type material.—5 females and 1 male from *Alveopora* sp. in 3.5 m, Nosy N'Tangam, on the western side of Nosy Bé, Madagascar. Collected October 23, 1964. Holotype female, allotype, and 3 paratype females deposited in the United States National Museum; the remaining paratype female (dissected) in the collection of A. G. Humes.

Female.—Body (Figs. 114 and 115) moderately slender, about 5.5 times longer than wide. Length 1.27 mm (1.23–1.35 mm) and greatest width 0.23 mm (0.22–0.23 mm), based on 5 specimens. External segmentation weakly indicated. Region dorsal to fifth legs with three nearly equal long posteriorly directed processes. Genital and postgenital segments fused (Fig. 116), form a short "tail," shield-shaped in dorsal view and only about one-sixth of total body length. Areas of attachment of egg sacs situated dorsally. Each sac (Fig. 115) $220 \times 140 \mu$, containing two eggs, each about $140 \times 120 \mu$. Caudal ramus (Fig. 117) elongated, $62 \times 23 \mu$, with one outer marginal and four terminal setae. Body surface with a few scattered small hairs.

Rostral area (Fig. 118) tongue-shaped and rounded. First antenna (Fig. 119) 4-segmented (the third segment in other species being here divided into two segments) and elongated, about 75μ in length. Setae long and naked. Armature: 3, 22 + 1 aesthete, 2 + 1 aesthete, and 7 + 1 aesthete. Second antenna (Fig. 120) slender, 4-segmented, and armed as in previous five species. Terminal claw 28μ long and slender, adjacent seta 18μ ; two setules near base of claw.

Labrum (Fig. 121) projected posteriorly at both free corners. Mandible (Fig. 121) with a pointed smooth blade. Paragnath not seen. First maxilla (Fig. 121) a small lobe with two setae. Second maxilla (Fig. 121) 2-segmented, second segment with two setae and a terminal lamellate expansion. Maxilliped (Fig. 122) probably 3-segmented. First segment with an outer distal expansion. Second segment with two inner setae and two expansions, one inner and the other distal. Third segment with a small lobe and a short terminal claw. Relationships of head appendages as in Figure 123.

Legs 1–4 with 3-segmented exopods and 2-segmented endopods. Spine and setal formula as follows:

P_1 and P_2 protopod 0–0; 1–0 exp 1–0; 1–0; 1, 3
end 0–0; 2

P_1 and P_2 protopod 0–0; 1–0 exp 1–0; 1–0; 1, 2
end 0–0; 0

In all four legs, basis with an outer seta and an inner group of hairs. Terminal claw on exopods unusually long, nearly as long as second and third segments combined. Endopods of legs 1 (Fig. 124) and 2 with second segment truncated terminally and bearing two setae; endopods of legs 3 (Fig. 125) and 4 with second segment rounded and without setae. In endopods of all four legs inner margin of first segment with hairs; outer margins of both segments with slender setules. Intercoxal plate of leg 1 broadly U-shaped, those of succeeding legs narrower.

Leg 5 (Fig. 126) elongated, 138μ long, tapered distally, and bearing two unequal terminal setae 17 and 34μ in length. Leg 6 absent.

Color in life in transmitted light opaque, intestine reddish orange, eye red, egg sacs dark gray.

Male.—The description of the male which follows is based on a single specimen, the allotype, which was studied in lactic acid without dissection.

Body (Figs. 127 and 128) moderately slender, about 8 times longer than wide, longer than female. Length 1.51 mm and greatest width 0.18 mm. External segmentation only weakly indicated. Caudal ramus (Fig. 129) minute, $20 \times 13 \mu$, with four setae. Genital and postgenital segments together about one-fifth of total body length.

Rostral area as in female. First antenna like that of female but with an aesthete added on second segment. Second antenna, labrum, mandible, first maxilla, and second maxilla as in female. Paragnath not seen. Maxilliped (Fig. 130) segmented and armed as in five previous species. Second segment with two inner setae. Claw 62μ along its axis, armed with the usual two setae. Concave inner proximal margin with a rounded serrated exerescence and tip of claw trifurcated.

Legs 1–4 segmented and armed as in female. Leg 5 (Fig. 131) minute, with only

a slight ridge bearing two setae representing the free segment. Leg 6 (Fig. 132) the usual posteroventral flap on genital segment bearing two setae.

Spermatophore not seen.

Color in life as in female.

Etymology.—The specific name *brevicauda*, from the Latin words *brevis* = short, and *cauda* = tail, refers to the unusually short genital and postgenital area.

Comparison with related species.—*X. brevicauda* may be distinguished from all previously described species in the genus by its abbreviated genital and postgenital region and by the serrated excrescence on the claw of the male maxilliped. Apart from these distinctions it may further be separated from those species having 2-segmented endopods in legs 1–4 (*X. dispar* Humes, 1962, *X. comata* Humes, 1962, *X. diminuta* Humes and Ho, 1967, *X. lamellispinosa*, and *X. decorata*) by the nature of the three outer spines on the exopods of legs 1–4 (the two proximal spines being short, the terminal spine longer than the last segment of the exopod).

Xarifia temnura n. sp.

Figs. 133–153

Type material.—12 females and 4 males from *Montipora sinensis* Bernard in a depth of 1 m, Nosy Taolankena, a small island on the northwestern side of Nosy Bé, Madagascar. Collected November 15, 1963. Holotype female, allotype, and 11 paratypes (8 females and 2 males) deposited in the United States National Museum; the remaining paratypes in the collection of A. G. Humes.

Female.—Body (Figs. 133 and 134) elongated and very slender, about 10 times longer than wide. Length 1.52 mm (1.47–1.65 mm) and greatest width 0.15 mm (0.14–0.15 mm), based on 10 specimens. External segmentation lacking. Region dorsal to fifth legs smooth, without processes. Area bearing these legs turned ventrally (Fig. 135) toward sites of attachment of egg sacs and partially overlapping

these regions of attachment laterally, thus producing a truncated appearance. Post-genital segments completely fused into a single body region which is relatively minute ($52\ \mu$ along its dorsal surface and $83\ \mu$ along its ventral surface, not including the caudal rami). This "tail" region, together with the caudal rami, only about one-thirteenth of total body length. Caudal ramus (Fig. 136) fused with anal segment, lobate, $28\ \mu$ long with four short naked setae. Egg sac (Fig. 133) elongated, with 3 or 4 eggs in a row. In the female figured, right sac $430\ \mu$ long with middle egg $140 \times 114\ \mu$, left sac $506\ \mu$ long with penultimate egg $130 \times 125\ \mu$. Body surface with very few small hairs.

Rostral area (Fig. 139) weakly developed. First antenna (Fig. 137) 3-segmented and very short, about $23\ \mu$ long. Setae hyaline and naked. Armature: 3, 15 + 1 aesthete, and 6 + 2 aesthetes (though setae so densely arranged that it is difficult to count exact number). Second antenna (Fig. 138) 4-segmented and armed as in six previous species. Terminal claw transformed to a relatively long spine ($28\ \mu$ in length); adjacent seta short ($4\ \mu$) and spiniform. A few small spines on anterior edge of second and third segments.

Labrum (Fig. 139) very slightly trilobed. Mandible (Fig. 140) with a pointed smooth blade. Paragnath (Fig. 139) consisting of a very small lobe with a few minute hairs. First maxilla (Fig. 141) a minute lobe with two naked setae. Second maxilla (Fig. 142) 2-segmented, second segment bearing two minute setae and a terminal clawlike spine. Maxilliped (Fig. 143) highly modified, with two inner setae on second segment and two smaller setae on what is probably the third segment. Relationships of head appendages as in Figure 139.

Legs 1–4 small, exopod of leg 1 (Fig. 144) 3-segmented, exopods of legs 2 (Fig. 146), 3, and 4 probably 3-segmented, but second and third segments of these legs without distinct line of separation; endo-

pods of all four legs 1-segmented. Spine and setal formula as follows:

P_1 protopod	0-0; 1-0	exp	1-0; 1-0; 1, 3
		end	1
P_2 protopod	0-0; 1-0	exp	1-0; 0-0; 1, 3
		end	1
P_3 and P_4 protopod	0-0; 1-0	exp	1-0; 0-0; 1, 2
		end	0

In all four legs, basis with an outer seta. Endopods of legs 1 (Fig. 145) and 2 (Fig. 146) with a single terminal seta; endopods of legs 3 (Fig. 147) and 4 without a seta. In all four endopods outer margin with numerous slender setules. Intercostal plate of leg 1 U-shaped, becoming narrower in succeeding legs.

Leg 5 (Figs. 135 and 148) minute, located dorsolaterally above truncated region. Free segment reduced to a small lobe about 5μ in length bearing two setae. Leg 6 absent.

Color in life in transmitted light opaque, intestine reddish brown, eye red, egg sacs reddish brown.

Male.—Body (Figs. 149 and 150) very slender, about 10.5 times longer than wide. Length 1.46 mm (1.43–1.50 mm) and greatest width 0.14 mm (0.13–0.15 mm), based on 4 specimens. External segmentation weakly indicated. Caudal ramus (Fig. 151) minute, 13μ long, fused with anal segment and bearing four setae; the two rami rather divergent. Genital and post-genital segments together about one-third of total body length. Body surface with very few scattered small hairs.

Rostral area as in female. First antenna like that of female but an aesthete added on second segment. Second antenna as in female. Labrum (Fig. 152) resembling that of female but with posterior margin having a pair of small teeth medially and a small tooth at each corner. Mandible, paragnath, first maxilla, and second maxilla as in female. Maxilliped (Fig. 153) segmented and armed as in six previous species. Second segment with two inner setae. Claw 42μ along its axis, armed with two setae. Concave margin proximally with a

rather triangular serrated process; tip of claw trifurcated.

Legs 1–4 segmented and armed as in female. Leg 5 (Fig. 150) very reduced, consisting only of three small setae, as in *X. lissa*. Leg 6 (Fig. 150) a posteroventral flap on genital segment bearing two small setae.

Spermatophore (seen only inside male, as in Figure 149) elongated.

Color in life as in female.

Etymology.—The specific name *temnura*, from the Greek words τέμνω = cut off and ὄψα = tail, refers to the truncated appearance of the posterior part of the body.

Comparison with related species.—The females of *X. temnura* may be recognized by the unique truncated posterior region and the very small postgenital area. In only three other species does the female lack processes on the region dorsal to the fifth legs. These are *X. reducta* Humes, 1962, *X. serrata* Humes, 1962, and *X. lissa*. All differ from *X. temnura*, however, in the body being much stouter (6–7 times longer than wide) and in the much longer fifth legs (*X. reducta* = 34μ , *X. serrata* = 122μ , and *X. lissa* = 72μ). The male of *X. temnura* differs from all other species having 1-segmented endopods on legs 1–4 in the nature of the claw of the maxilliped and in the form of the caudal ramus.

Xarifia anomala n. sp.

Figs. 154–173

Type material.—2 females and 3 males from *Acropora palifera* (Lamarck) in a depth of 2 m, Tany Kely, a small island to the south of Nosy Bé, Madagascar. Collected October 3, 1963. Holotype female, allotype, and 1 male paratype deposited in the United States National Museum; the remaining paratypes (dissected) in the collection of A. G. Humes.

Female.—Body (Figs. 154 and 155) moderately slender, about 7.8 times longer than wide. Length 1.25 mm (1.25–1.26 mm) and greatest width 0.16 mm (0.16–0.17 mm), based on 2 specimens. External segmentation very weakly indicated. Re-

gion dorsal to fifth legs with three moderately long posteriorly directed processes, all nearly equal in length. Genital and post-genital region recurved in specimens in alcohol, with caudal rami turned dorsally (Fig. 156), this entire region comprising about one-fifth of total body length. Areas of attachment of egg sacs located dorso-laterally. Egg sac unknown. Caudal ramus (Fig. 157) elongated, $52 \times 15 \mu$, with one outer marginal and four terminal naked setae. Body surface with a few scattered small hairs.

Rostral area forming a prominent rounded lobe (Fig. 161), similar to that of male (Fig. 168). First antenna small, about 33μ in length, probably 3-segmented, though last two segments seem partially divided; similar to that of male (Fig. 168). Armature: 3, 22 (no aesthete visible here), and $9 + 2$ aesthetes. Second antenna (Fig. 158) 4-segmented and armed as in previous seven species. Terminal claw recurved and slender, 10μ long, with adjacent seta 19μ in length.

Labrum of a form similar to that of male (Fig. 169). Mandible a smooth attenuated recurved blade as in male (Fig. 170). Paragnath an obscure minute smooth prominence near inner base of first maxilla. First maxilla (Fig. 159) a small lobe with two setae and a small spinous process. Second maxilla 2-segmented, second segment with two small setae and an elongated lamellate expansion, as in male (Fig. 171). Maxilliped (Fig. 160) probably 3-segmented. First segment with a well sclerotized almost hooklike lobe on distal outer surface. Second segment with two inner setae. Third segment with a spiniform process and a terminal lamellate element. Relationships of head appendages as in Fig. 161.

Legs 1-4 with 3-segmented exopods and 2-segmented endopods. Spine and setal formula as follows:

P_1 protopod 0-0; 1-0 exp 1-0; 1-0; 1, 3
end 0-0; 0
 P_2 protopod 0-0; 1-0 exp 1-0; 1-0; 1, 2
end 0-0; 3

P_3 and P_4 protopod 0-0; 1-0 exp 1-0; 1-0; 1, 2
end 0-0; 0

In all four legs intercoxal plates narrow and V-shaped; basis with an outer seta and an inner group of hairs. Claws on exopods with short but conspicuous terminal lamellae. Second segment of endopod of leg 1 (Fig. 162) without terminal setae (though slender setules occur along outer margin of segment). Second segment of endopod of leg 2 (Fig. 163) with three terminal setae. Legs 3 and 4 resembling in general structure first two legs, but second endopod segment without terminal setae.

Leg 5 (Fig. 164) elongated, about 100μ in length, tapered distally, with two unequal terminal setae 13 and 23μ long. Leg 6 absent.

Color in life unknown.

Male.—Body (Figs. 165 and 166) fairly slender, about 9 times longer than wide. Length 1.21 mm (1.15-1.25 mm) and greatest width 0.13 mm (0.12-0.14 mm), based on 3 specimens. External segmentation very weak. Genital and postgenital segments together about one-fourth of total body length. Caudal ramus (Fig. 167) reduced to five setae arising directly from anal segment.

Rostral area and first antenna (Fig. 168) like those in female, as far as could be determined. (The presence of an extra aesthete in the male, as often found in this genus, could not be established.) Second antenna as in female. Labrum (Fig. 169), mandible (Fig. 170), paragnath, first maxilla, and second maxilla (Fig. 171) resembling those of female. Maxilliped (Fig. 172) segmented and armed as in seven previous species. Second segment with two unequal inner setae. Claw 28μ along its axis, armed with two setae. Concave margin with a few spinules and tip of claw trifurcated.

Legs 1-4 segmented and armed as in female. Leg 5 (Fig. 173) consisting of three small setae, arising from body wall and without a free segment. Leg 6 (Fig. 173) the usual posteroventral flap on genital segment with two small setae.

Spermatophore seen only inside body of male, as in Figure 173.

Color in life unknown.

Etymology.—The specific name *anomala*, from ἀνώμαλος = uneven or unequal, refers to the peculiar formula for the terminal armature of the endopods of legs 1–4.

Comparison with related species.—*X. anomala* may be distinguished from the six already described species of *Xarifia* which have 2-segmented endopods on legs 1–4 by the absence of terminal setae on the endopod of its first leg and by the extreme sexual dimorphism in the caudal ramus. Three of these six species, *X. dispar* Humes, 1962, *X. comata* Humes, 1962, and *X. decorata*, have the outer spine on the second segment of the exopod of leg 1 reduced or absent, thus further separating them from the new species. Of the remaining three species, *X. brevicauda* has a shorter post-genital region, *X. lamellispinosa* has a short stout claw on the second antenna and a toothed mandible, and *X. diminuta* Humes and Ho, 1967, has relatively short stout spines on the exopods of legs 1–4.

Xarifia hamata n. sp.

Figs. 174–194

Type material.—64 females and 16 males from *Turbinaria* sp. (tabulate group, near *T. elegans* Bernard but not this species) in a depth of 2 m, Nosy Taolankena, a small island off the northwestern shore of Nosy Bé, Madagascar. Collected November 15, 1963. Holotype female, allotype, and 58 paratypes (45 females and 13 males) deposited in the United States National Museum; 11 paratype females in the Museum of Comparative Zoology; and the remaining paratypes in the collection of A. G. Humes.

Female.—Body (Figs. 174 and 175) moderately slender, about 6.3 times longer than wide. Length 1.38 mm (1.29–1.42 mm) and greatest width 0.22 mm (0.21–0.22 mm), based on 10 specimens. External segmentation weakly indicated, except in a few specimens where postgenital segments are

more clearly delimited (Fig. 176). Region dorsal to fifth legs with three moderately long posteriorly directed processes, all nearly equal in length. Genital and post-genital region short and held at a slight angle to main body axis, this region comprising about one-seventh of total body length. Areas of attachment of egg sacs situated dorsolaterally. Egg sac (Fig. 175) about $374 \times 198 \mu$, containing usually 5, but sometimes 6 eggs, each about 115μ in diameter. Caudal ramus (Fig. 177) not clearly delimited from anal segment, approximately $41 \times 17 \mu$ (width taken at middle), with a strong outer marginal seta and four more slender terminal setae. All setae naked. Dorsal surface of ramus with a few hairs. Body surface ornamented with very few minute hairs.

Rostral area resembling that of *X. lamellispinosa*. First antenna (Fig. 178) small, about 55μ in length, apparently 3-segmented, though second and third segments show partial division. Armature: 3, 22 + 1 aesthete, and 9 + 2 aesthetes. Second antenna (Fig. 179) 4-segmented and armed as in eight previous species. Last segment terminally with a slender claw 13μ long, a seta 19μ , a small setule, and a minute spinous process.

Labrum (Fig. 180) with trilobate free margin. Mandible (Fig. 181) with a sinuous smooth attenuated blade. Paragnath a small lobe with a few hairs, similar to that shown for the male in Figure 193. First maxilla (Fig. 182) with two naked setae and a spinous process. Second maxilla (Fig. 183) 2-segmented, second segment elongated with two proximal inner setae and a third seta near its obtuse hyaline tip. Maxilliped (Fig. 184) 3-segmented, second segment with two inner setae, third with two inner setae and terminating in a clawlike process. Relationships of head appendages as in Figure 185.

Legs 1–4 with similar form and segmentation, exopods 3-segmented, endopods 2-segmented. Spine and setal formula as follows:

P₁ protopod 0-0: 1-0 exp 1-0: 1-0: I, 3
end 0-0: 2

P₂ protopod 0-0: 1-0 exp 1-0: 1-0: I, 3
end 0-0: I, 1

P₃ and P₄ protopod 0-0: 1-0 exp 1-0: I-0: I, 2
end 0-0: I

First segment of exopod of all four legs with a spiniform process at base of outer spine; second segment of these exopods with an outer seta instead of a spine. In all four legs inner margins of first and second segments of exopods and outer margins of both segments of endopods with long hairs. Terminal segment of endopod of leg 1 with two setae (Fig. 186), of leg 2 with an outer seta and an inner clawlike spine (Fig. 187), and of legs 3 and 4 with a single clawlike spine (Fig. 188). Leg 4 (not drawn) similar to leg 3. Intercostal plates roughly V-shaped in all four legs.

Leg 5 (Fig. 189) moderately elongated, about 58 μ long, tapered distally, with two unequal terminal setae 24 and 32 μ long. Leg 6 absent.

Color in life in transmitted light slightly brownish, intestine reddish brown, eye red, egg sacs reddish brown to dark grayish black.

Male.—Body (Figs. 190 and 191) slender, about 9.1 times longer than wide. Length 1.28 mm (1.15–1.56 mm) and greatest width 0.14 mm (0.13–0.14 mm), based on 10 specimens. External segmentation weakly defined except in some specimens in post-genital area (Fig. 192). Genital and post-genital segments together less than one-third of total body length. Caudal ramus similar to that of female but smaller and relatively broader, 25 \times 13 μ .

Rostral area as in female. First antenna like that of female, but with four aesthetes, one being added on midanterior margin of middle segment. Second antenna as in female. Labrum resembling that of female but with a minute toothlike process on corners of outer lobes. Mandible, paragnath (Fig. 193), first maxilla, and second maxilla as in female. Maxilliped (Fig. 194) segmented and armed as in eight previous species. Second segment with two

inner setae. Claw 40 μ along its axis, armed with two setae. Concave margin with a few minute serrations near distal seta.

Legs 1–4 segmented and armed as in female. Leg 5 without a free segment, consisting of three small setae, two of them arising from a very slight ridge (Fig. 192). Leg 6 the usual posteroventral flap on genital segment bearing two small setae (Fig. 192).

Spermatophore seen only inside body of male, as in Figure 192.

Color in life resembling that of female.

Etymology.—The specific name *hamata*, from Latin = provided with hooks, refers to the clawlike spines on the endopods of legs 2–4.

Comparison with related species.—*X. hamata* may be distinguished from all other nineteen species in the genus by the combination of the following three characters: the endopods in all four legs 2-segmented, the endopods of legs 3 and 4 with a clawlike terminal spine, and the exopods of all four legs with a spinal armature of I, 1, I. The presence of a clawlike spine on the second segment of the endopod in legs 2–4 is sufficient to separate the new species from all others in the genus (where the endopods either bear setae or are unarmed, though they may be ornamented with slender setules or hairs).

Xarifia dispar Humes, 1962

This species has been previously recorded only from *Echinopora carduus* Klunzinger in Madagascar. It is now reported from two new hosts as follows:

1) from *Echinopora gemmacea* (Lamarck): 3 females and 7 males in 2 m, northern end of Nosy Sakatia, off the western side of Nosy Bé, Madagascar, September 18, 1963; 6 females and 3 males in 1 m, Pte. de Tafondro, Nosy Bé, September 21, 1963.

2) from *Echinopora lamellosa* (Esper): 6 females and 7 males in 1 m, Pte. Ambar-

ionaomby, Nosy Komba, near Nosy Bé, June 24, 1963.

The specimens from the two new hosts agree in all significant features with paratypic specimens. Although in the original description paragnaths were said to be absent, we have found both in paratypic specimens and in the new material two small elongated lobes which are clearly paragnaths.

Xarifia serrata Humes, 1962

The type specimens of this species were taken by Humes (1962) in Madagascar from *Pocillopora damicornis* Dana. He found other specimens on *Seriatopora subseriata* Ehrenberg and *Pocillopora verrucosa* (Ellis and Solander). The species was again reported from *Seriatopora subseriata* by Humes and Frost (1964).

We have now recovered it from a new host, *Pocillopora bulbosa* Ehrenberg, from which 29 females and 34 males were taken in 10 cm at Ankify, on the mainland of Madagascar opposite Nosy Komba, June 11, 1964. These specimens agree completely with paratypic material.

ORSTOMELLA n. gen.

Type species.—*Orstomella faviae* n. sp.

Female.—Body elongated, slender, with indistinct segmentation. Region dorsal to fifth legs without processes. Rostral area weakly developed. Caudal ramus with a few short terminal setae.

First antenna 6-segmented, first segment with an anterior process, remaining segments with numerous short setae. Second antenna 3-segmented, terminal segment (with slight indication of division into two segments) bearing two unequal elements.

Labrum with widely separated lobes. Mandible and paragnath absent. First maxilla with three elements. Second maxilla 2-segmented. Maxilliped 3-segmented.

Legs 1 and 2 with 2-segmented exopods and endopods. Legs 3 and 4 with 2-segmented exopods, but endopods absent. Leg 5 a ridge with three setae. Leg 6 absent.

Male.—Resembling female with following exceptions. First antenna with four aesthetes. Lateral margins of labral lobes with crenated depressions. First maxilla with two elements. Maxilliped probably 4-segmented, claw short. Leg 6 a posteroventral flap with two very small setae.

Living in polyps of madreporarian corals.

Gender feminine.

Etymology.—The name *Orstomella* is formed from ORSTOM, the abbreviation for the Office de la Recherche Scientifique et Technique Outre-Mer, the organization of the French Government which operates the Centre O.R.S.T.O.M. (formerly the Centre d'Océanographie et des Pêches) at Nosy Bé, Madagascar, and which has aided in so many ways the field work in connection with this study.

Orstomella faviae n. sp.

Figs. 195–219

Type material.—11 females, 8 males, and 4 copepodids from two colonies of *Favia* sp. in a depth of 2 m, west of Pte. Mahatsinjo, Nosy Bé, Madagascar. Collected April 10, 1964. Holotype female, allotype, and 12 paratypes (7 females and 5 males) deposited in the United States National Museum; the remaining paratypes (dissected) in the collection of A. G. Humes.

Female.—Body (Figs. 195 and 196) elongated and slender, about 6.4 times longer than wide, slightly thickened dorsoventrally in prosomal region, with indistinct segmentation and lacking fine ornamentation. Length 2.19 mm (2.10–2.26 mm) and greatest width 0.34 mm (0.32–0.36 mm), based on 10 specimens. Region dorsal to fifth legs without processes. Genital and postgenital segments together about one-third of total body length. Genital segment (Fig. 197) bipartite, the anterior third narrow ($78 \times 179 \mu$) with areas of attachment of egg sacs dorsolateral in position, the posterior two-thirds broader ($177 \times 198 \mu$). Three postgenital segments 133×180 , 55×144 , and $107 \times 122 \mu$ from anterior to posterior. Last segment with a prominent anal

operculum. Caudal ramus (Fig. 198) moderately elongated, $80 \times 26 \mu$, about 3 times longer than wide; bearing terminally a seta 20μ and a minute spinule 3μ long, and having on its proximal outer margin a hyaline setule 6μ long. Egg sac unknown.

Rostral area (Fig. 199) weakly developed. First antenna (Fig. 199) short, about 80μ in length, and 6-segmented, bearing numerous short setae which are sclerotized proximally but hyaline distally with somewhat obtuse tips. Lengths of segments (measured along their posterior non-setiferous margins) 15, 24, 14, 9, 9, and 8μ respectively. First segment with an anterior process (probably not a true element, since it has no articulation). Formula for armature: 0, 3, 6, 4, 3, 6. A few minute spinules on surface of segments. Second antenna (Fig. 200) 3-segmented, about 44μ long without setae; first segment wide with an anteroventral jointed seta 16μ long; second segment elongated, slender, and unarmed; third segment also elongated and slender, with slight indication of division and bearing terminally a jointed seta 15μ and a short spine 5μ long.

Labrum (Fig. 201) with two lobes widely separated and both bearing a surficial seta; other fine ornamentation as indicated in figure. Mandible and paragnath absent. First maxilla (Fig. 202) a small lobe with three distally hyaline elements, two of them bipartite as shown in figure. Second maxilla (Fig. 203) 2-segmented, first segment large and unarmed, second small, bearing two hyaline obtuse elements and a spinous process and prolonged terminally as a rather obtuse process with hyaline border (cf. Figures 203 and 204). Maxilliped (Fig. 205) apparently 3-segmented; first segment unarmed; second segment indistinctly separated from third and bearing two short elements, one straight, the other recurved; third segment small, armed with one hyaline obtuse element and having a terminal prolongation with hyaline lamellae. Labrum and mouthparts situated close together (Fig. 206) with a small median ven-

tral lobe (see Figure 201) between the second maxillae and maxillipeds.

Leg 1 (Fig. 207) and leg 2 with 2-segmented exopods and endopods. Leg 3 (Fig. 209) and leg 4 with 2-segmented exopods, but without endopods. Spine and setal formula as follows:

P_1 and P_2 protopod	0-0: 1-0	exp	1-0; (1), 1
		end	0-0; 1
P_3 and P_4 protopod	0-0: 1-0	exp	1-0; 1, 1
		end	-

Low median ventral protuberances in front and behind first three pairs of legs (seen in lateral view in Figure 196).

In leg 1, first segment of exopod with a small outer spine, second segment with a minute outer spine (or spinous process?) and a terminal clawlike spine which is swollen on its concave edge (Fig. 208). Endopod with first segment unarmed, second segment with a single partly hyaline and obtusely tipped terminal seta and a small hyaline lobe. Leg 2 similar to leg 1.

In leg 3 both segments of exopod with a small outer spine and second segment with terminal clawlike spine having hyaline lamellae (cf. Figures 209 and 210). Endopod absent. Leg 4 similar to leg 3.

Leg 5 (Fig. 211) consisting of a low slightly sclerotized ridge with three obtuse and mostly hyaline setae 9, 13, and 8μ in length. Position of this leg as in Figure 196.

Leg 6 absent.

Color in life in transmitted light bright red, with eye darker red.

Male.—Body (Figs. 212 and 213) resembling that of female, about 7.6 times longer than wide. Length 2.12 mm (1.99–2.24 mm) and greatest width 0.28 mm (0.23–0.34 mm), based on 8 specimens. Genital and postgenital segments together about one-third of total body length. Genital segment (Fig. 214) wider than long, $138 \times 256 \mu$. Four postgenital segments 185×216 , 143×190 , 65×143 , and $104 \times 122 \mu$ from anterior to posterior. Caudal ramus as in female, but slightly longer, $91 \times 23 \mu$, with the large terminal seta 23μ long.

Rostral area as in female. First antenna

(Fig. 215) segmented and armed as in female, except for three aesthetes being added on segment 3 and one aesthete on segment 4, making the formula 0, 3, 6 + 3 aesthetes, 4 + 1 aesthete, 3, and 6. Second antenna as in female.

Labrum (Fig. 216) with two lobes smaller than in female and having lateral depressions with well sclerotized crenated edges. Mandible and paragnath absent. First maxilla (Fig. 217) a small lobe with only two elements. Second maxilla as in female. Maxilliped (Figs. 218 and 219) probably 4-segmented, but segmentation obscure. First segment unarmed, second large with two inner hyaline setae, third small and unarmed. Fourth segment forming a short terminal blunt claw $19\ \mu$ in length bearing two unequal elements. Relationships of mouthparts as in female.

Legs 1-4 as in female.

Leg 5 similar to that of female.

Leg 6 (Fig. 214) consisting of a posteroventral flap on genital segment bearing two minute setae 8 and $6\ \mu$ long.

Spermatophore seen only inside body of male, as in Figure 213.

Color in life as in female.

Etymology.—The specific name *faviae* is derived from the generic name of the host.

Orstomella lobophylliae n. sp.

Figs. 220-239

Type material.—10 females and 16 males from *Lobophyllia costata* (Dana) in a depth of 6-8 m, Ambariobe, a small island nearly between Nosy Komba and Nosy Bé, Madagascar. Collected December 28, 1963. Holotype female, allotype, and 20 paratypes (7 females and 13 males) deposited in the United States National Museum; the remaining paratypes (dissected) in the collection of A. G. Humes.

Other specimen.—1 female from *Lobophyllia corymbosa* (Forskål) in 1 m, Ambariobe, January 13, 1964.

Female.—Body (Figs. 220 and 221) in general appearance similar to preceding species, but much smaller, about 5.5 times

longer than wide. Length 1.20 mm (1.23-1.39 mm) and greatest width 0.22 mm (0.17-0.24 mm), based on 9 specimens. Region dorsal to fifth legs without processes. Genital and postgenital segments together about four-tenths of total body length. Genital segment (Fig. 222) bipartite, the anterior half $70 \times 140\ \mu$, relatively not as narrow as in preceding species, with areas of attachment of egg sacs lateral in position; the posterior half $101 \times 127\ \mu$. Three postgenital segments 90×102 , 40×80 , and $44 \times 78\ \mu$ from anterior to posterior. Last segment with a prominent anal operculum. Caudal ramus (Fig. 223) short, $26 \times 15\ \mu$, nearly two times longer than wide, bearing terminally two setae 18 and $11\ \mu$ and a minute spinule $3\ \mu$ long, and having on its proximal outer margin a hyaline setule $10\ \mu$ long. Egg sac unknown.

Rostral area (Fig. 224) not well developed. First antenna (Fig. 224) short, about $84\ \mu$ in length, and 6-segmented, bearing numerous short hyaline setae. Lengths of segments (measured along their posterior non-setiferous margins) 20, 24, 11, 10, 9, and $9\ \mu$, respectively. First segment having an anterior process with recurved tip. Two setae on segment 2 and one on segment 3 modified, without evident articulation and with terminal flagella. Formula for armature: 0, 3, 6, 4, 3, 6. A few minute setules on surface of segments. Second antenna (Fig. 225) 3-segmented, short, only $27\ \mu$ long without the setae; first two segments unarmed, third segment (showing slight indication of division) with terminally a jointed seta $15\ \mu$ and a short spine $6\ \mu$.

Labrum (Fig. 226) resembling that of previous species, but two lobes smaller. Mandible and paragnath absent. First maxilla (Fig. 227) similar to preceding species, with three terminal elements, but the two bipartite elements attenuated. Second maxilla (Fig. 228) similar to preceding species, but terminal prolongation of second segment setiform. Maxilliped (Fig. 229) resembling that of *O. faviae*. Labrum and

mouthparts held close together as in that species.

Leg 1 (Fig. 230) and leg 2 with 2-segmented exopods and endopods. Leg 3 (Fig. 231) and leg 4 with 2-segmented exopods, but without endopods. Spine and setal formula as follows:

P_1 and P_2 protopod	0-0; 1-0	exp	1-0; (1), 1; 1, 1
		end	0-0; 1
P_3 and P_4 protopod	0-0; 1-0	exp	1-0; 1, 1
		end	-

Low median ventral protuberances in front and behind first three pairs of legs (Fig. 221) as in *O. faviae*.

In leg 1 first segment of exopod with a small outer spine, second segment with a minute outer spine (or spinous process?), a minute spinule, a terminal clawlike spine, and an inner setule. Endopod with first segment unarmed, second segment bearing a terminal seta, with nearby on anterior surface a minute setule and a small patch of denticles. Leg 2 similar to leg 1.

In leg 3 both segments of exopod with a small outer spine, and second segment with clawlike terminal spine having hyaline lamellae. Endopod absent. Leg 4 like leg 3, but second segment with minute outer spine smaller (Fig. 232).

Leg 5 (Fig. 233) consisting of a low ridge with three setae 10, 12, and 9 μ long, more attenuated than in *O. faviae*.

Leg 6 absent.

Color in life in transmitted light bright red, with eye darker red.

Male.—Body (Figs. 234 and 235) similar to that of the female, about 7 times longer than wide. Length 1.30 mm (1.20–1.45 mm) and greatest width 0.19 mm (0.16–0.23 mm), based on 10 specimens. Genital and postgenital segments together (Fig. 236) about one-third of total body length. Caudal ramus as in female but slightly larger, $29 \times 16.5 \mu$.

Rostral area as in female. First antenna similar to that of female, but with four aesthetes added as in male of preceding species. Second antenna as in female.

Labrum (Fig. 237) with both lobes hav-

ing a lateral depression with crenated edges. Mandible and paragnath absent. First maxilla (Fig. 238) with only two elements. Second maxilla as in female. Maxilliped (Fig. 239) resembling that of *O. faviae*, the terminal claw 17 μ long. Relationships of mouthparts as in female.

Legs 1–4 as in female.

Leg 5 similar to that of female.

Leg 6 (Fig. 236) a posteroventral flap on genital segment bearing two minute setae about 3 μ in length.

Spermatophore seen only inside body of male, as in Figure 235.

Color in life as in female.

Etymology.—The specific name *lobophylliae* is derived from the generic name of the host.

Comparison with the type species.—*Orstomella lobophylliae* differs in significant respects from *O. faviae*. It is much smaller (female 1.20, male 1.30 mm) than that species (female 2.19, male 2.12 mm). The caudal ramus of the female is shorter ($26 \times 15 \mu$, or about 2:1) than in *O. faviae* ($80 \times 26 \mu$, or about 3:1). There are three modified flagellated setae on the first antenna, while in *O. faviae* all the setae are similar. The first segment of the second antenna is unarmed, while in *O. faviae* this segment bears a jointed seta. In leg 5 the three setae are obtuse, but in *O. faviae* they are attenuated. Other minor differences exist in the armature of the mouthparts and in legs 1–4.

Relationship of ORSTOMELLA with the hosts.—Both *O. faviae* and *O. lobophylliae* evidently live in the polyps of the corals. Specimens were recovered in the sediment obtained after allowing the corals to remain overnight in alcoholized sea water (containing about 5 percent ethyl alcohol). They were never found after rinsing the freshly collected corals for only a few minutes. The copepods apparently are stimulated by the weak alcohol to emerge from the polyps, when they fall to the bottom of the container. Since the copepods are unable to swim, they are unable to regain

their positions in the coral after the effects of the alcohol diminish.

The taxonomic position of ORSTOMELLA.—In its elongated body form and its close association with corals, the genus *Orstomella* is suggestive of the genus *Xarifia* Humes, 1960.

There are, however, several important features which distinguish the two genera. In *Orstomella* the processes dorsal to the fifth legs in the female, characteristic of most *Xarifia*, are absent; the first antenna is clearly 6-segmented, instead of 3-segmented (with in some species a partial division of segments 2 and 3) as in *Xarifia*; the second antenna is 3-segmented (with slight indication of partial division of segment 3), instead of 4-segmented (3-segmented in *X. obesa* and a few others); the labrum shows marked sexual dimorphism, instead of weak dimorphism or none in *Xarifia*; the mandible and paragnath are absent, while in *Xarifia* there is a mandible in all species and a paragnath in some; the exopods of legs 1-4 are 2-segmented, instead of 3-segmented in *Xarifia*; and the endopods of legs 3 and 4 are absent, but present in *Xarifia*.

These differences might be regarded as sufficiently fundamental to justify placing *Orstomella* in a separate family. When, however, the range of variation within the genus *Xarifia* is considered, and the tendencies toward simplification and reduction exhibited by *Orstomella* are kept in mind, it seems unlikely to us that *Orstomella* truly represents a familial divergence. In certain species of *Xarifia*, for example, there are no processes dorsal to the fifth legs in the female, the second antenna is 3-segmented, the labrum shows weak sexual dimorphism, the mandible is reduced to a very minute blade, the paragnath may be absent, and the exopods of legs 1-4, though 3-segmented, may show a marked reduction

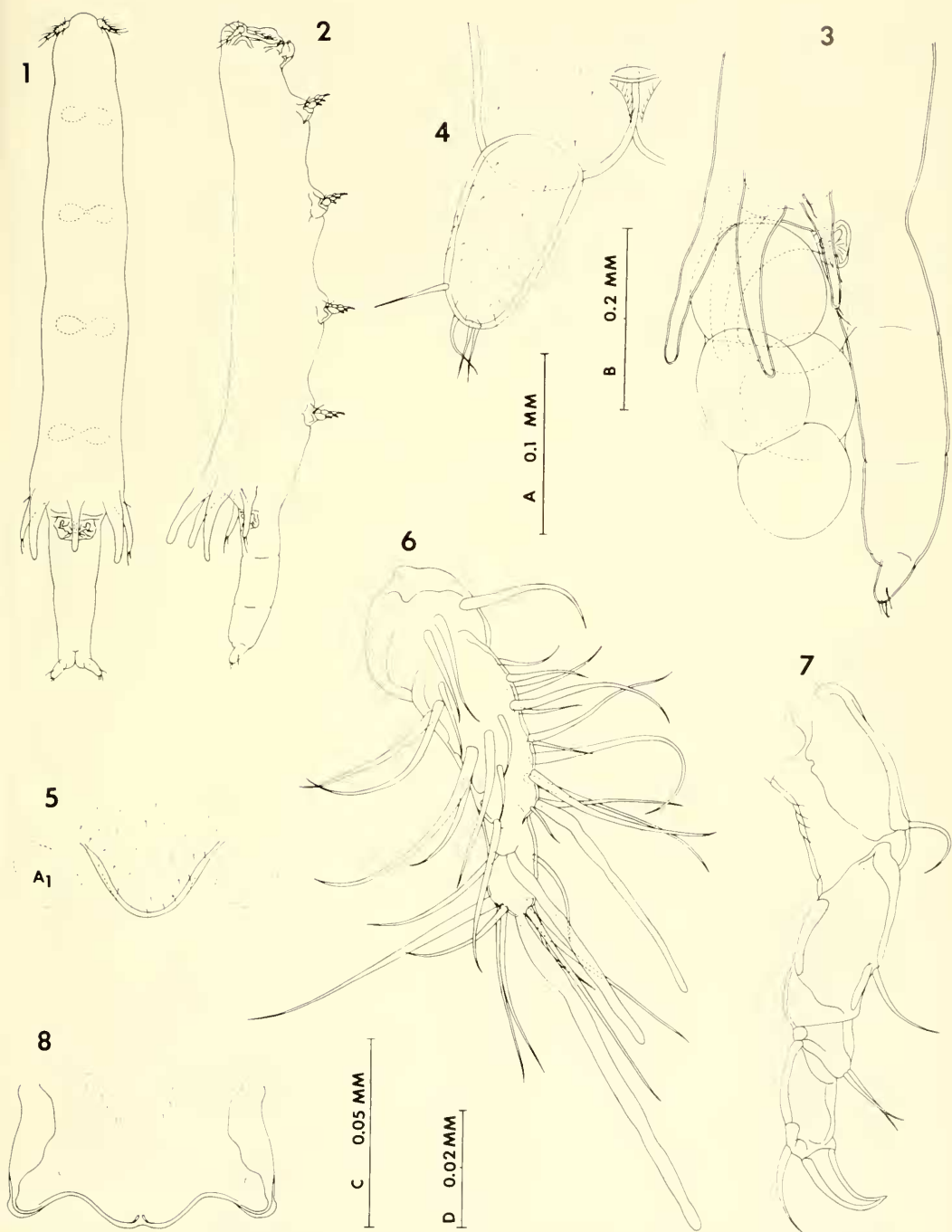
of the second segment. The differences in the segmentation of the first antenna (6-segmented in *Orstomella*, 3-segmented with sometimes partial division of segments 2 and 3 in *Xarifia*) and the nature of the endopods of legs 3 and 4 (absent in *Orstomella*, 1- or 2-segmented in *Xarifia*) seem to be intrafamilial features. Differences of a similar degree exist within other poccilostome families, for example, the Lichomolgidae. The absence of a mandible in *Orstomella*, while of fundamental importance, may simply represent an extreme in intrafamilial reduction, a strong tendency toward reduction of this appendage being already seen in certain *Xarifia*.

For these reasons we place *Orstomella* provisionally in the Xarifiidae, along with the genus *Xarifia*. The study of further collections of related copepods from corals would undoubtedly clarify the relationships of these two genera.

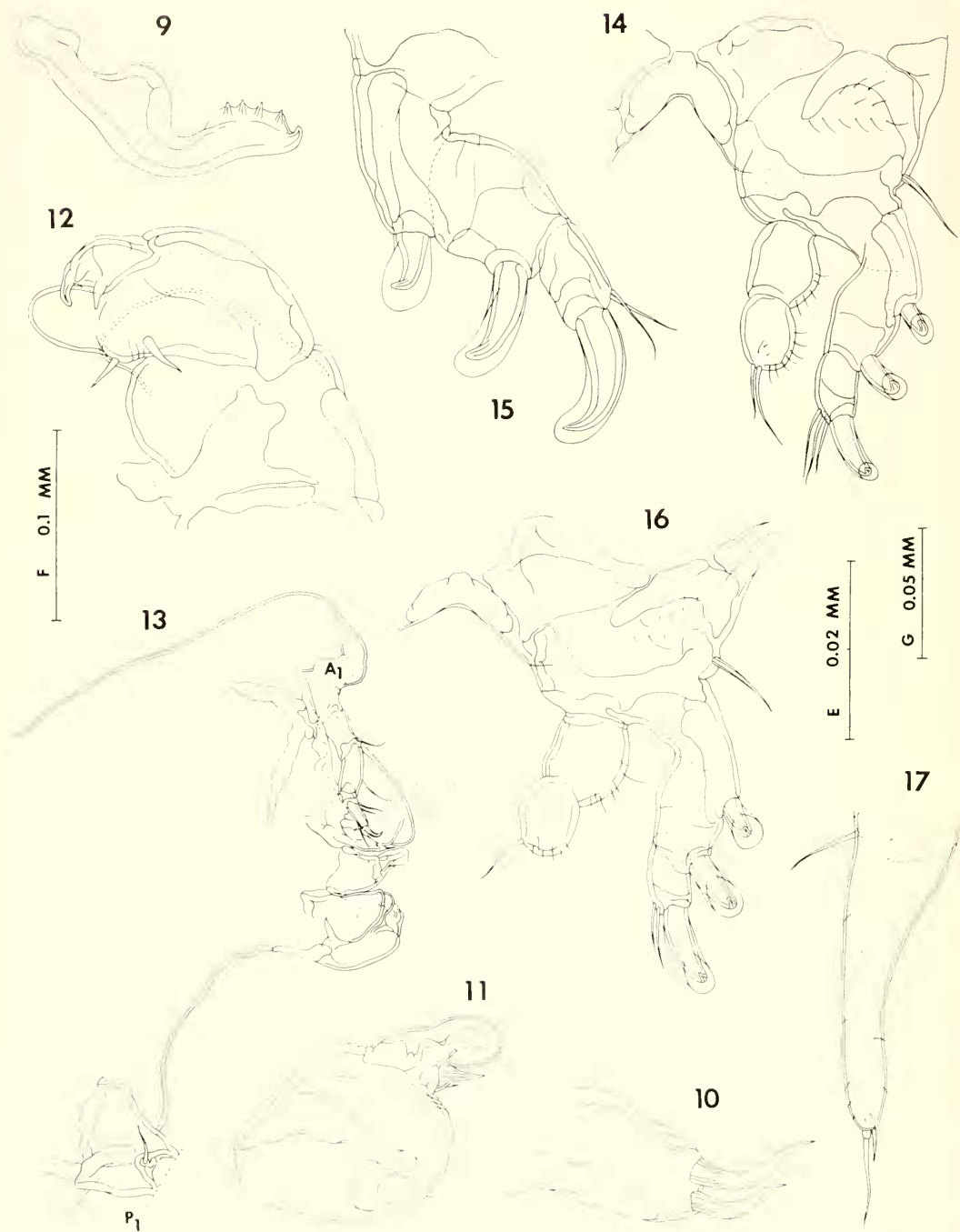
REFERENCES CITED

- HUMES, A. G. 1960. New copepods from madreporarian corals. *Kieler Meeresforschungen*, **16** (2): 229-235.
- . 1962. Eight new species of *Xarifia* (Copepoda, Cyclopoida), parasites of corals in Madagascar. *Bull. Mus. Comp. Zool.*, **128** (2): 37-63.
- . 1962. *Kombia angulata* n. gen., n. sp. (Copepoda, Cyclopoida) parasitic in a coral in Madagascar. *Crustaceana*, **4** (1): 47-56.
- HUMES, A. G. AND B. W. FROST. 1964. New lichomolgid copepods (Cyclopoida) associated with alcyonarians and madreporarians in Madagascar. *Cahiers ORSTOM Océanographie*, 1963, No. 6 (sér. Nosy Bé 2): 131-212.
- HUMES, A. G. AND J.-S. HO. 1967. New cyclopoid copepods associated with the coral *Psammodora contigua* (Esper) in Madagascar. *Proc. U. S. Nat. Mus.*, **122** (3586): 1-32.
- HUMES, A. G. AND J.-S. HO. 1968. Lichomolgid copepods (Cyclopoida) associated with corals in Madagascar. *Bull. Mus. Comp. Zool.*, **136** (10): 353-413.

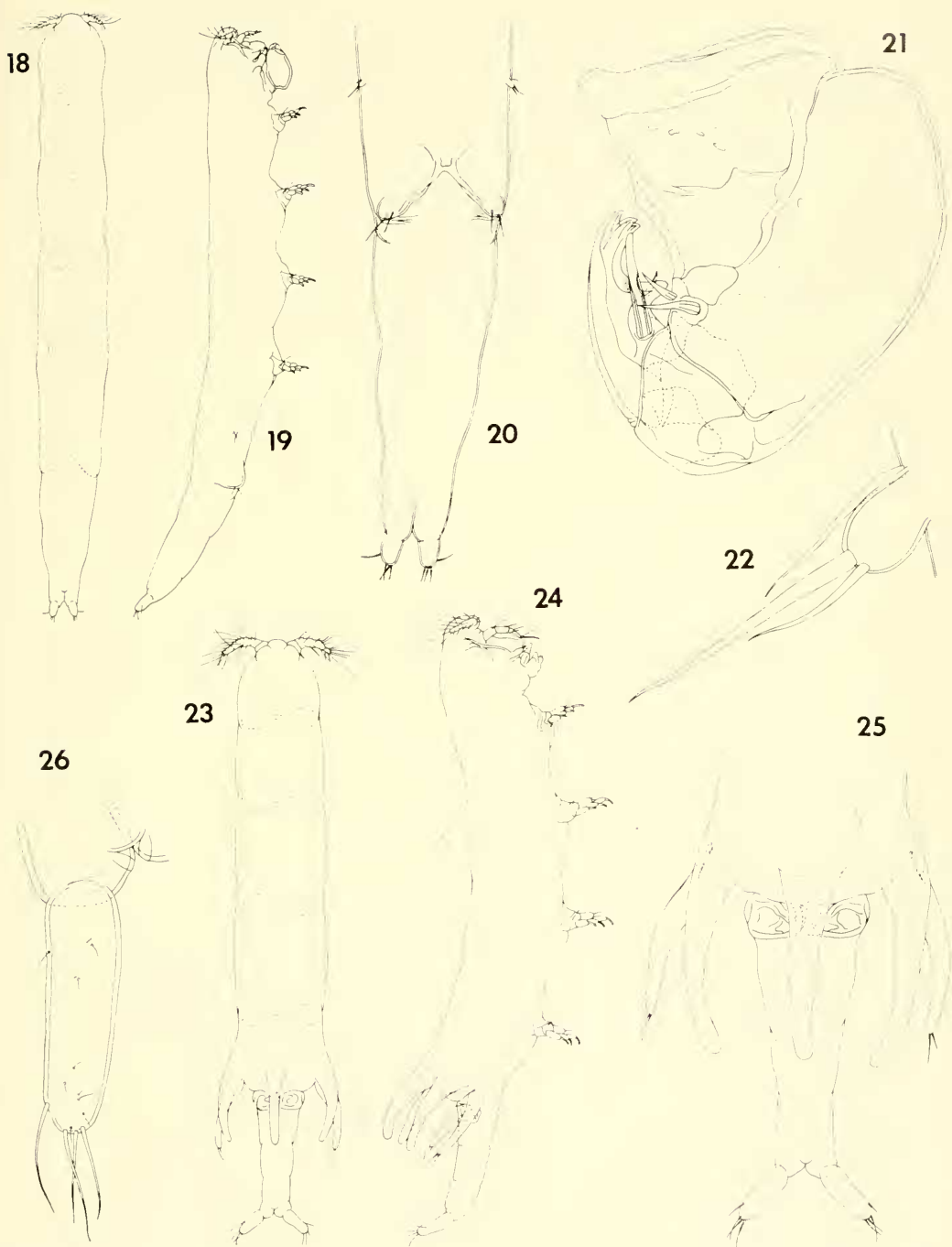
(Received 8 March 1967.)



Figures 1-8. *Xaritia lamellispinosa* n. sp., female. 1, body, dorsal (A); 2, body, lateral (A); 3, posterior part of body and egg sac, lateral (B); 4, caudal ramus, dorsal (C); 5, rostrum, ventral (C); 6, first antenna, anterodorsal (D); 7, second antenna, ventral (D); 8, labrum, ventral (C).

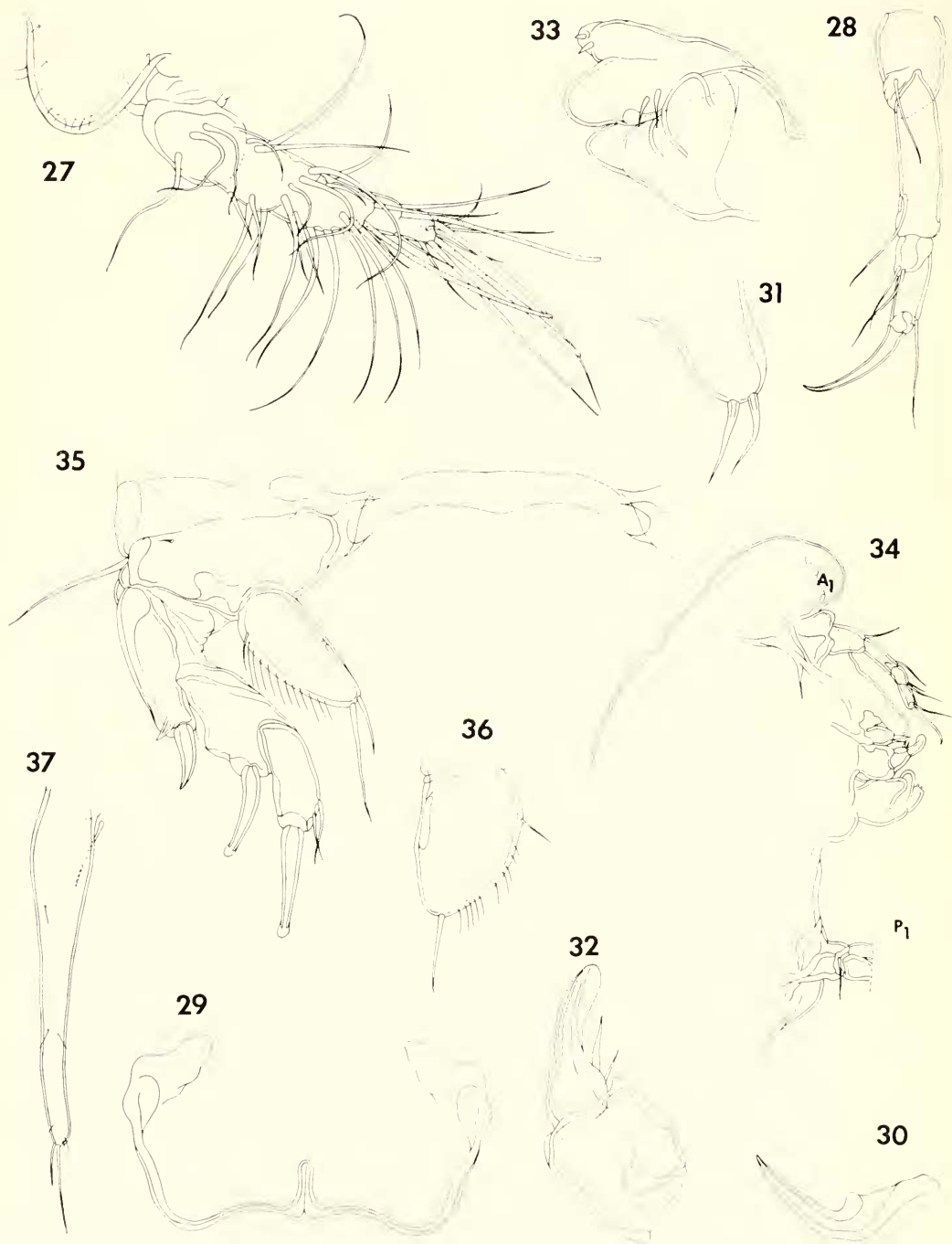


Figures 9-17. *Xarifia lamellispinosa* n. sp., female (continued). 9, mandible, dorsal (E); 10, first maxilla, dorsal (C); 11, second maxilla, anterior (D); 12, maxilliped, inner (D); 13, anterior part of body, lateral (F); 14, leg 1 and intercoxal plate, posterior (C); 15, exopod of leg 2, posterior (D); 16, leg 3 and intercoxal plate, posterior (C); 17, leg 5, lateral (G).

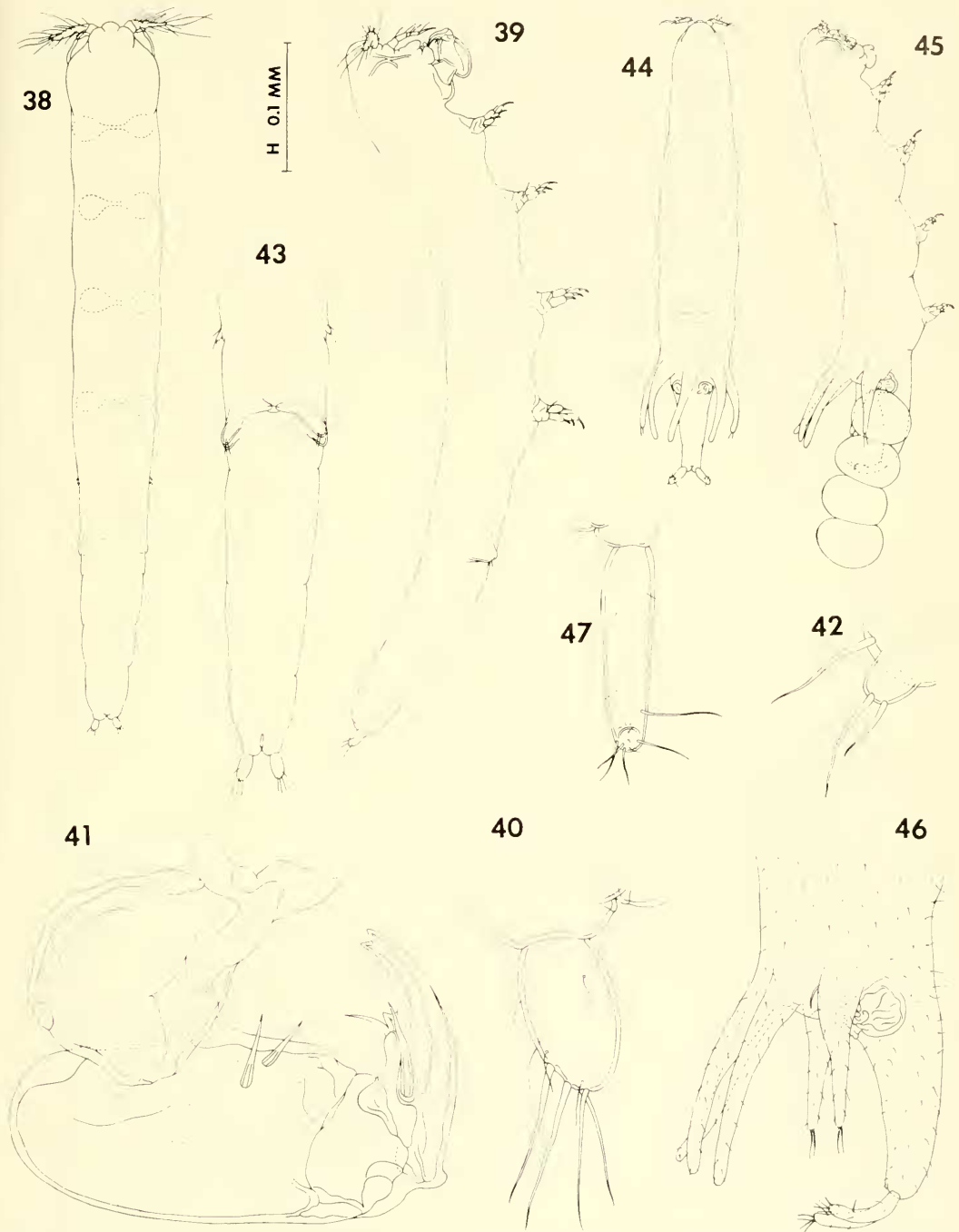


Figures 18–22. *Xorifio lamellispinosa* n. sp., male. 18, body, dorsal (A); 19, body, lateral (A); 20, urosome, ventral (B); 21, maxilliped, medial (C); 22, leg 5, ventral (E).

Figures 23–26. *Xorifio exigua* n. sp., female. 23, body, dorsal (B); 24, body, lateral (B); 25, urosome, dorsal (F); 26, caudal ramus, dorsal (D).

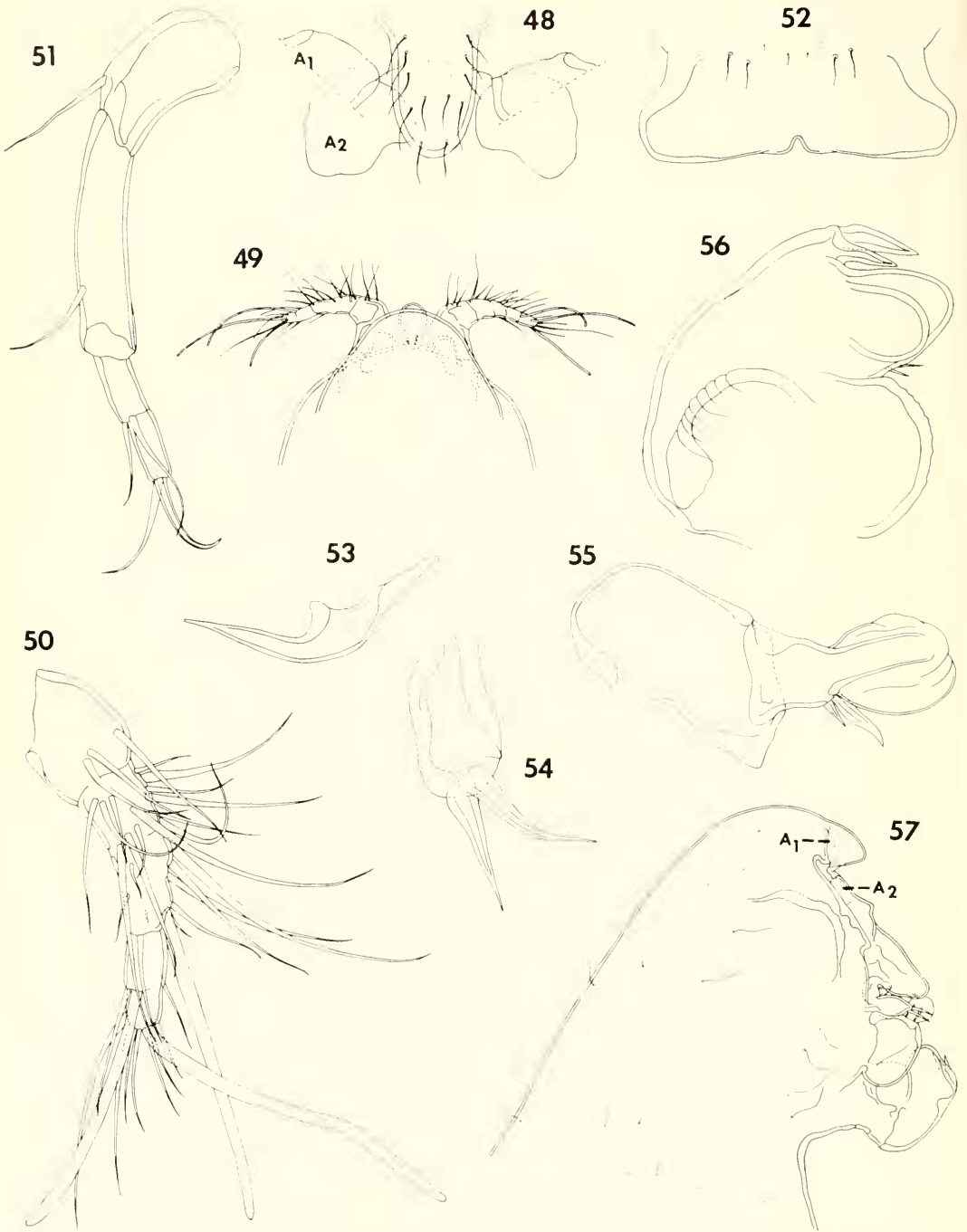


Figures 27-37. *Xaritia exigua* n. sp., female (continued). 27, rostrum and first antenna, anteroventral (D); 28, second antenna, ventral (D); 29, labrum, anteroventral (C); 30, mandible, anteroventral (E); 31, first maxilla, anteroventral (E); 32, second maxilla, anteroventral (E); 33, maxilliped, inner (E); 34, anterior part of body, lateral (G); 35, leg 1 and intercoxal plate, anterior (E); 36, endopod of leg 3, anterior (E); 37, leg 5, lateral (C).

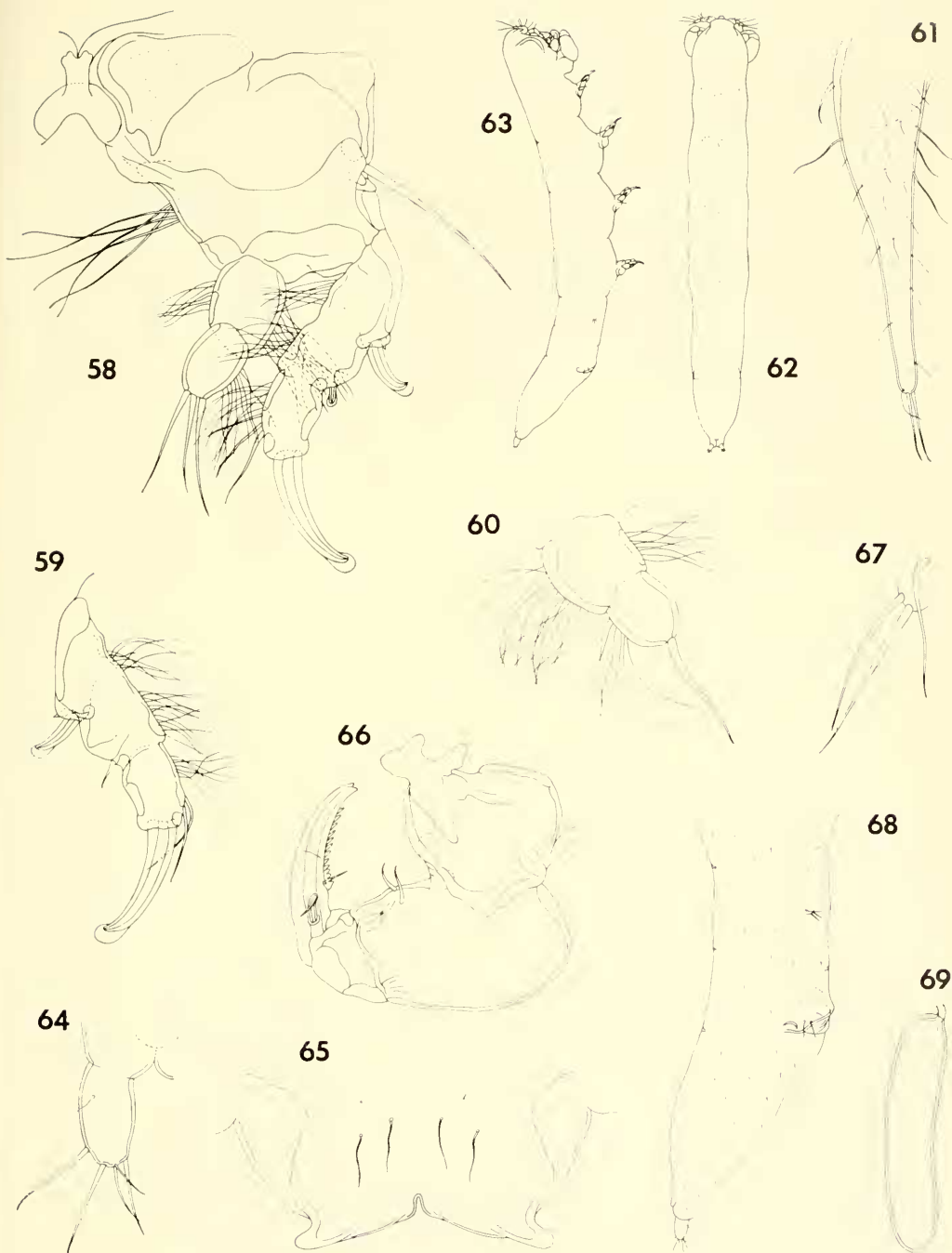


Figures 38-43. *Xarifia exigua* n. sp., male. 38, body, dorsal (B); 39, body, lateral (B); 40, caudal ramus, dorsal (E); 41, maxilliped, inner (E); 42, leg 5, lateral (E); 43, urosome, ventral (H).

Figures 44-47. *Xarifia decorata* n. sp., female. 44, body, dorsal (A); 45, body, lateral (A); 46, urosome, lateral (B); 47, caudal ramus, dorsal (G).

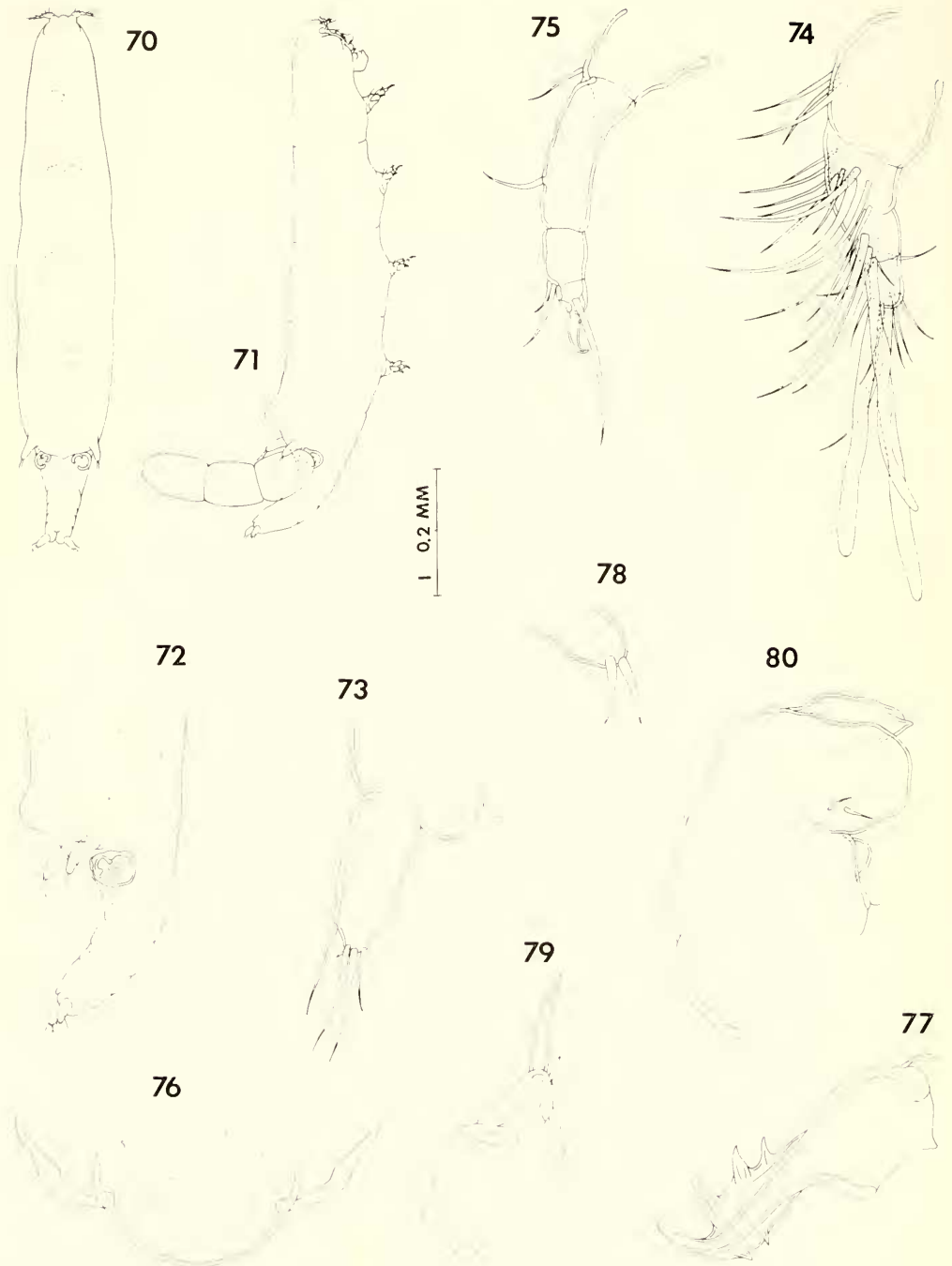


Figures 48-57. *Xariffia decorata* n. sp., female (continued). 48, rostral area, anteroventral (D); 49, anterior end of body, dorsal (F); 50, first antenna, ventral (D); 51, second antenna, ventral (D); 52, labrum, ventral (D); 53, mandible, ventral (E); 54, first maxilla, ventral (E); 55, second maxilla, ventral (D); 56, maxilliped, inner (D); 57, anterior part of body, lateral (F).

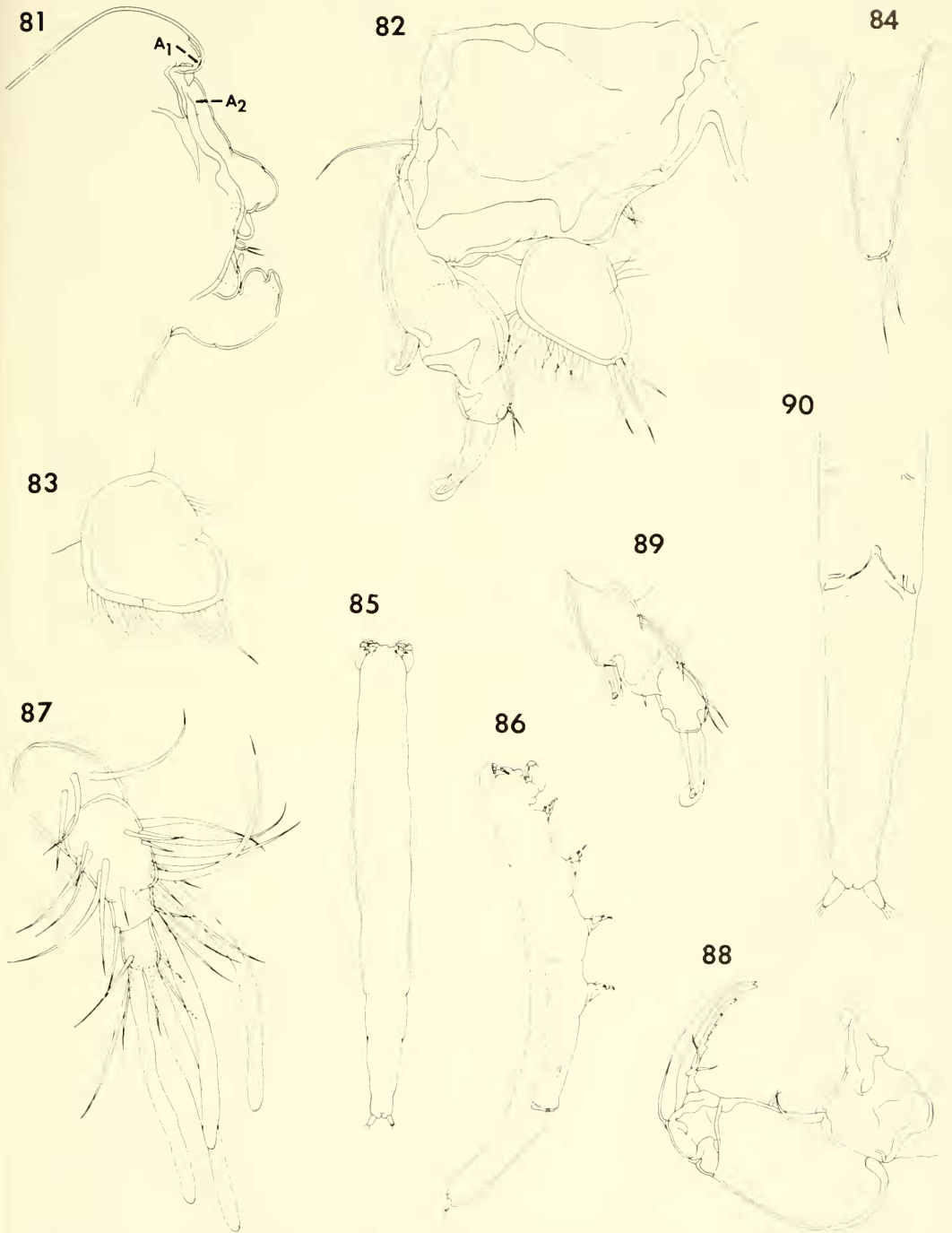


Figures 58-61. *Xaritia decorata* n. sp., female (continued). 58, leg 1 and intercoxal plate, posterior (D); 59, exopod of leg 2, posterior (D); 60, endopod of leg 3, posterior (D); 61, leg 5, lateral (F).

Figures 62-69. *Xaritia decorata* n. sp., male. 62, body, dorsal (A); 63, body, lateral (A); 64, caudal ramus, ventral (C); 65, labrum, ventral (D); 66, maxilliped, inner (G); 67, leg 5, lateral (D); 68, urosome, lateral (B); 69, spermatophore, attached to female, lateral (B).

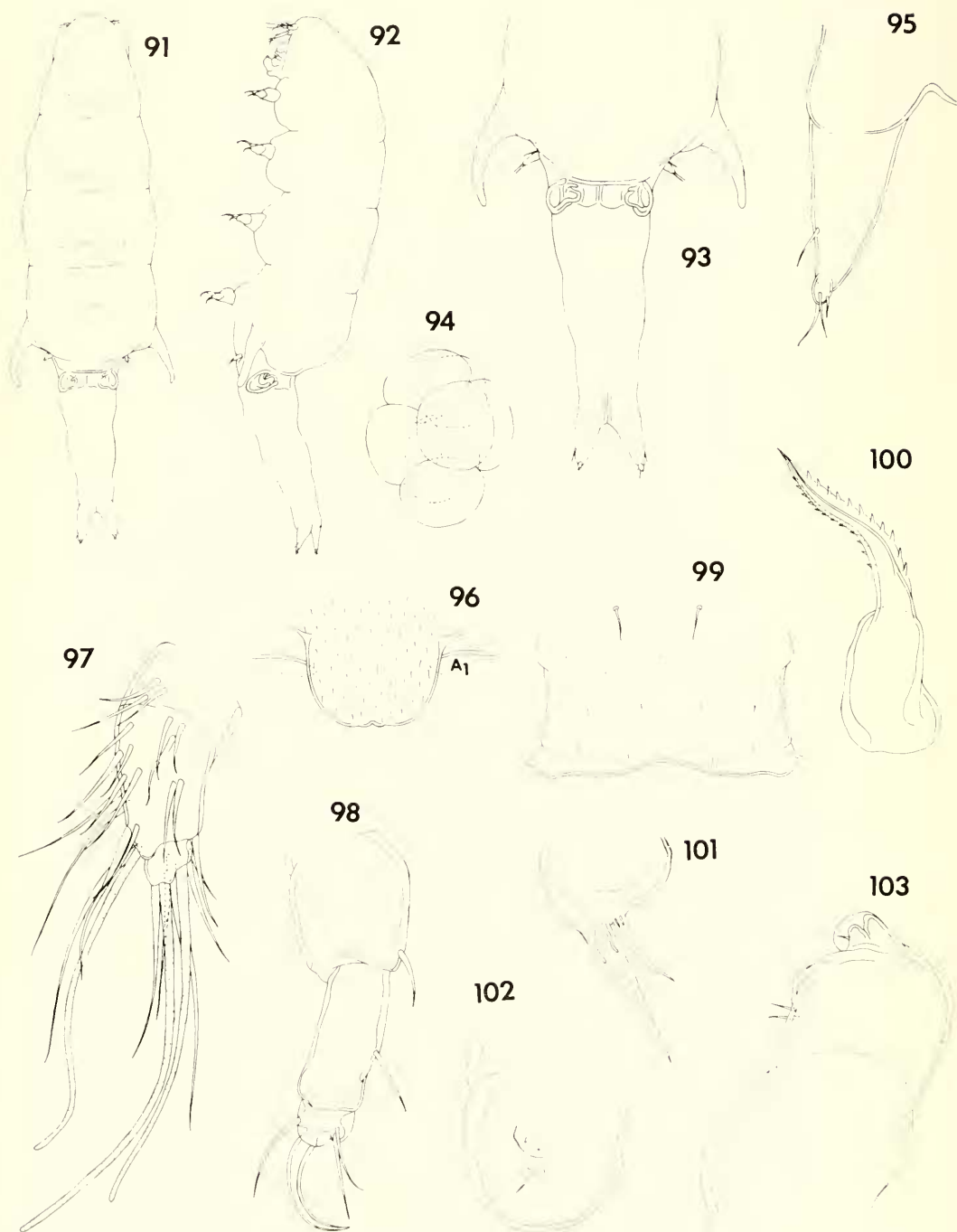


Figures 70-80. *Xaritia lissa* n. sp., female. 70, body, dorsal (A); 71, body, lateral (A); 72, urosome, lateral (I); 73, caudal ramus, ventral (C); 74, first antenna, dorsal (D); 75, second antenna, ventral (D); 76, labrum, ventral (D); 77, mandible, ventral (E); 78, first maxilla, ventral (E); 79, second maxilla, ventral (E); 80, maxilliped, inner (D).

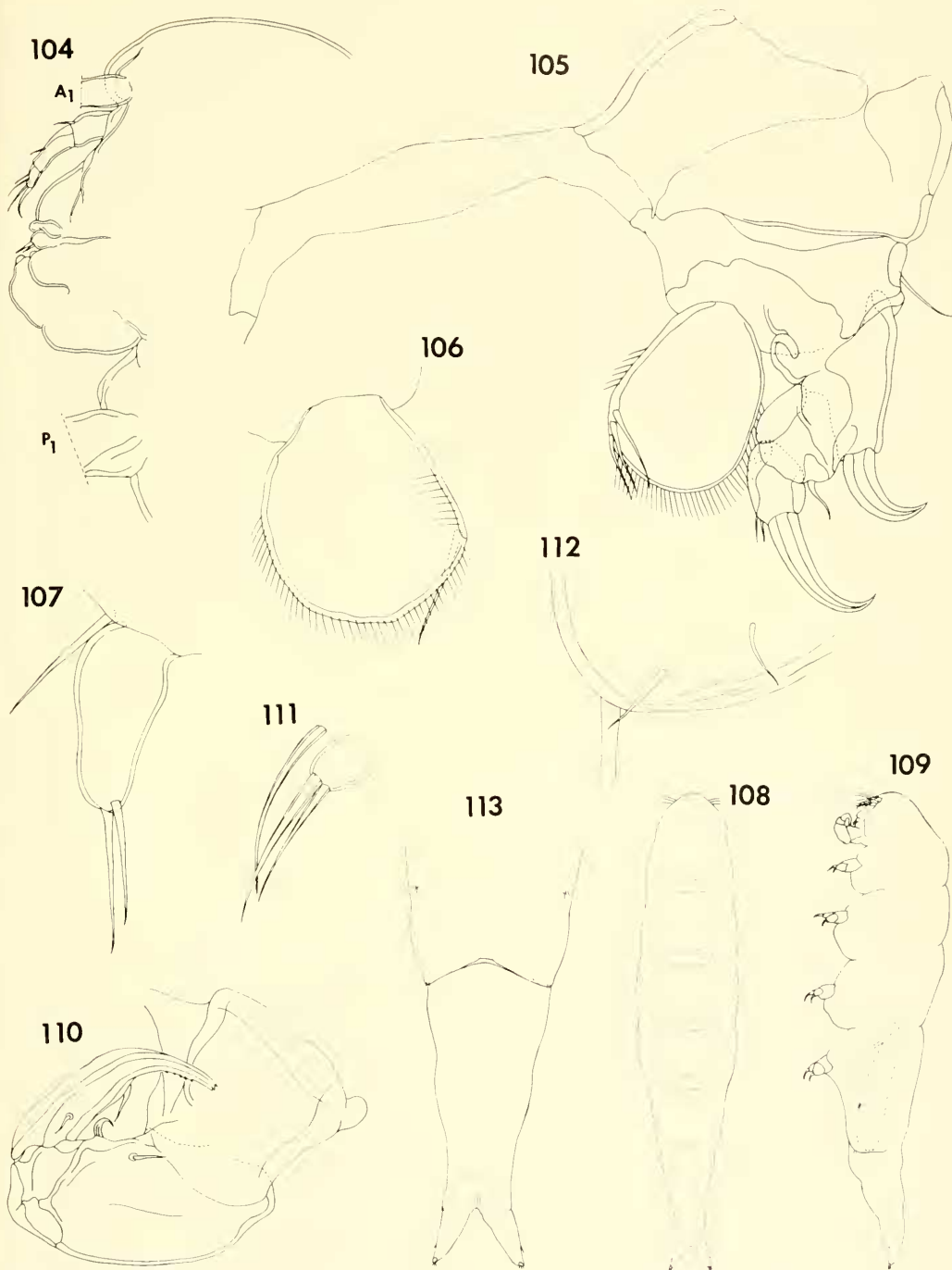


Figures 81-84. *Xarifia lissa* n. sp., female (continued). 81, anterior part of body, lateral (F); 82, leg 1 and intercoxal plate, posterior (D); 83, endopod of leg 3, posterior (D); 84, leg 5, lateral (G).

Figures 85-90. *Xarifia lissa* n. sp., male. 85, body, dorsal (A); 86, body, lateral (A); 87, first antenna, onteroventral (D); 88, mottilliped, inner (C); 89, exopod of leg 1, posterior (D); 90, urosome, ventral (B).

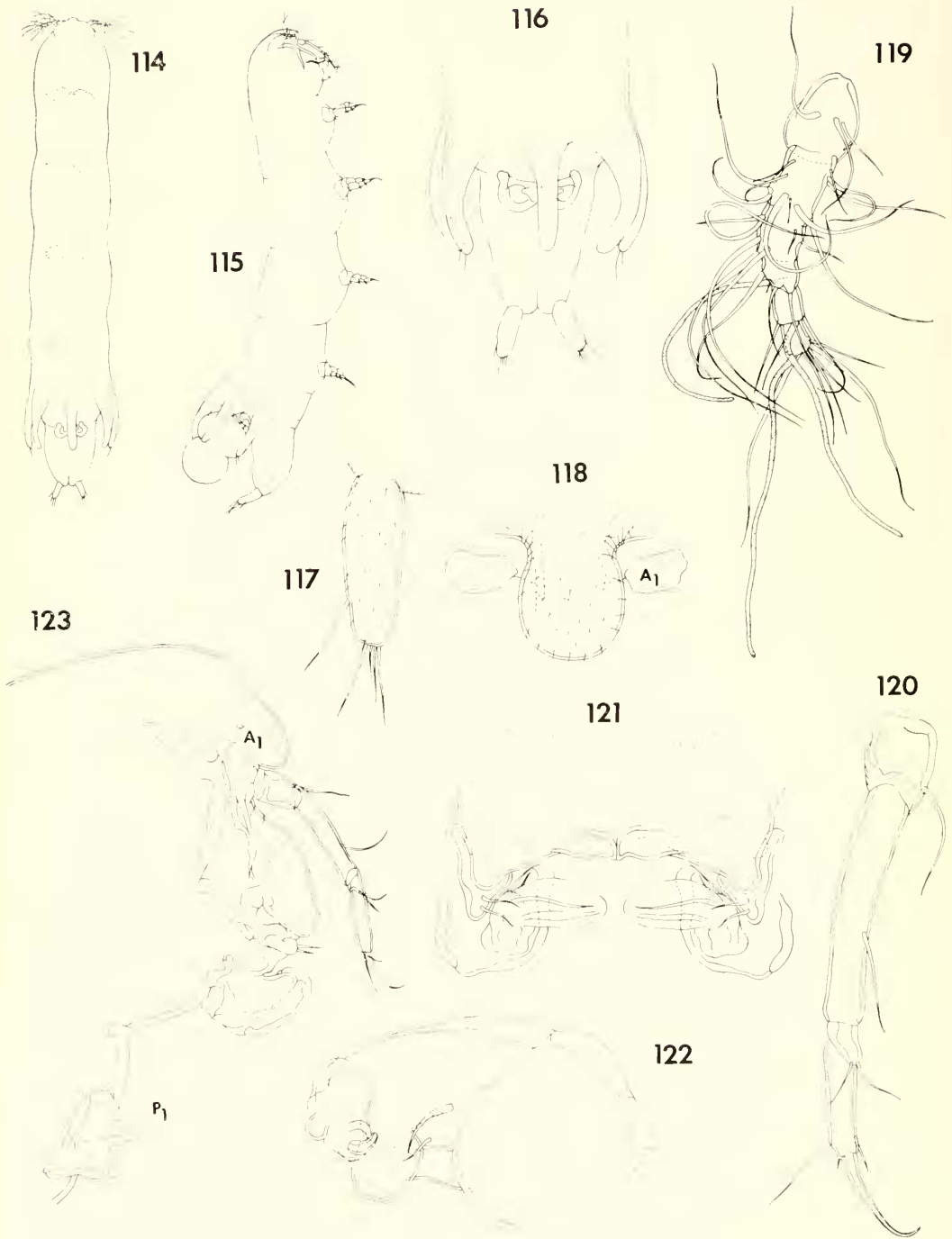


Figures 91–103. *Xaritia abesa* n. sp., female. 91, body, dorsal (A); 92, body, lateral (A); 93, urosome, dorsal (I); 94, egg sac, dorsal (I); 95, caudal ramus, dorsal (G); 96, rastrum, anteraventral (C); 97, first antenna, anterior (D); 98, second antenna, anteraventral (D); 99, labrum, ventral (C); 100, mandible, ventral (E); 101, first maxilla, ventral (E); 102, second maxilla, ventral (E); 103, maxilliped, outer (D).

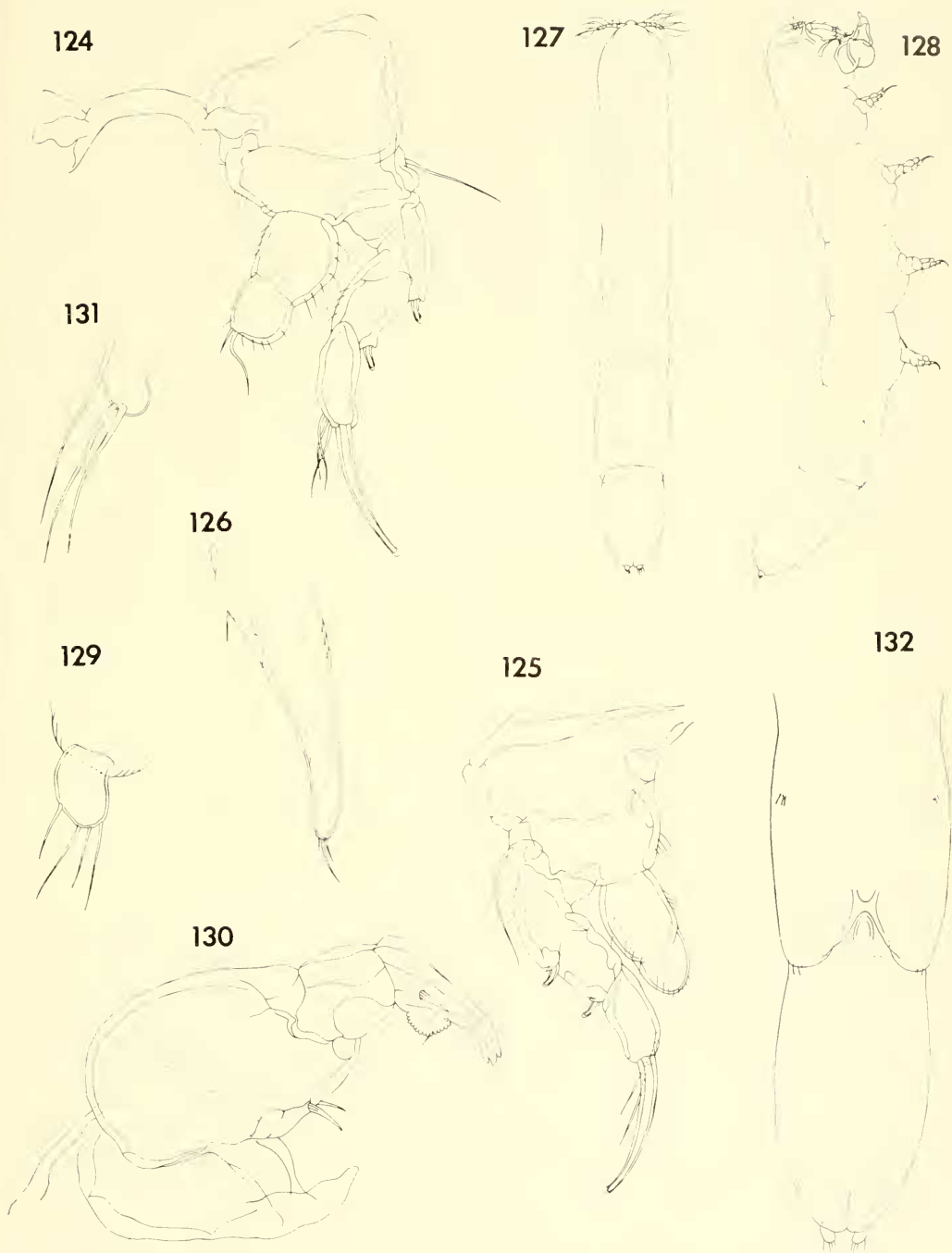


Figures 104-107. *Xarifio obesa* n. sp., female (continued). 104, anterior part of body, lateral (F); 105, leg 1 and intercoxal plate, posterior (D); 106, endopod of leg 3, anterior (D); 107, leg 5, ventral (D).

Figures 108-113. *Xarifio obesa* n. sp., male. 108, body, dorsal (A); 109, body, lateral (A); 110, maxilliped, inner (C); 111, leg 5, ventral (E); 112, leg 6, ventral (E); 113, urosome, ventral (B).

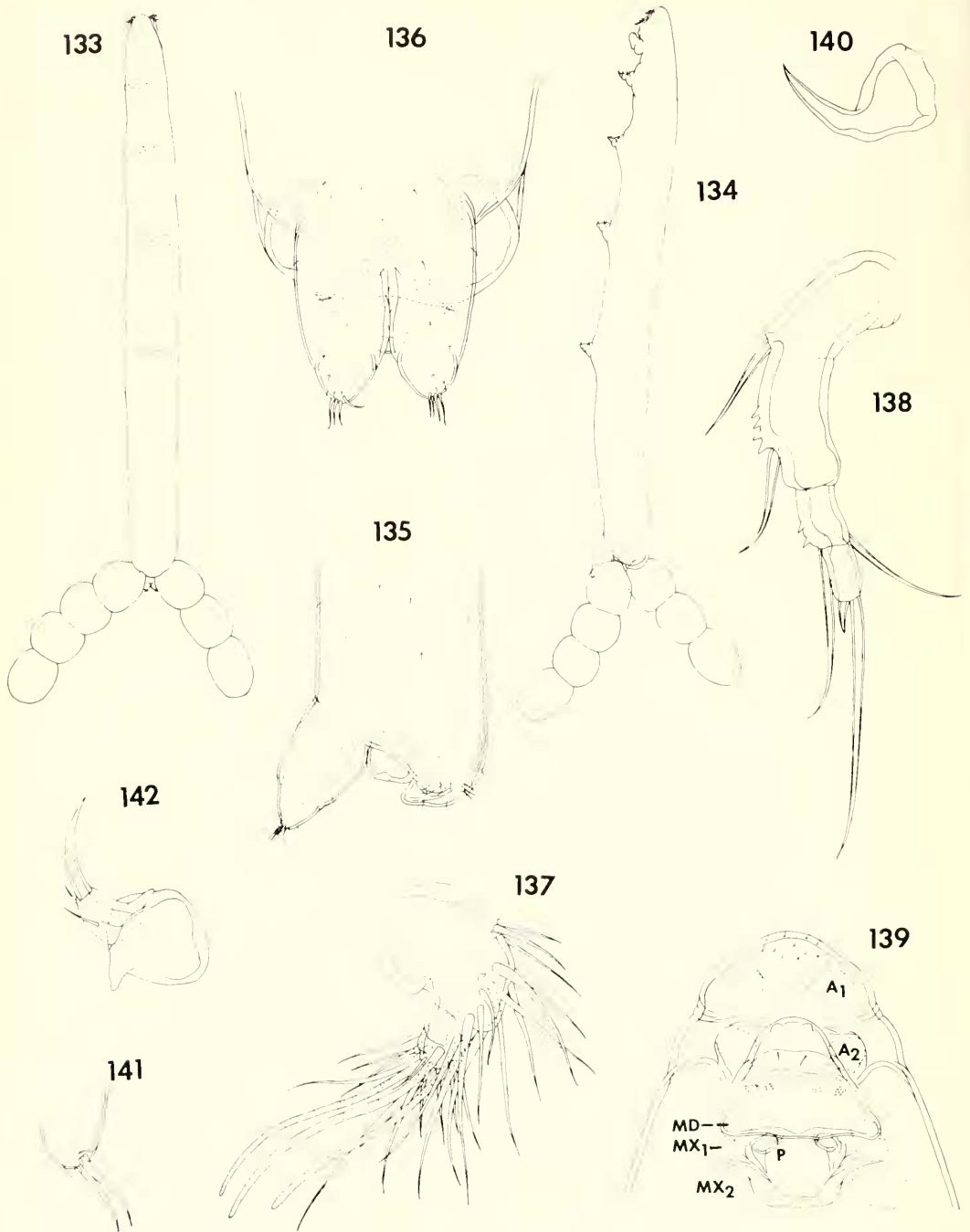


Figures 114-123. *Xarifa brevicauda* n. sp., female. 114, body, dorsal (A); 115, body, lateral (A); 116, urosome, dorsal (B); 117, caudal ramus, dorsal (G); 118, rostral area, anteroventral (C); 119, first antenna, anteroventral (C); 120, second antenna, ventral (C); 121, labrum and mouthparts, anteroventral (C); 122, maxilliped, inner (D); 123, anterior part of body, lateral (F).

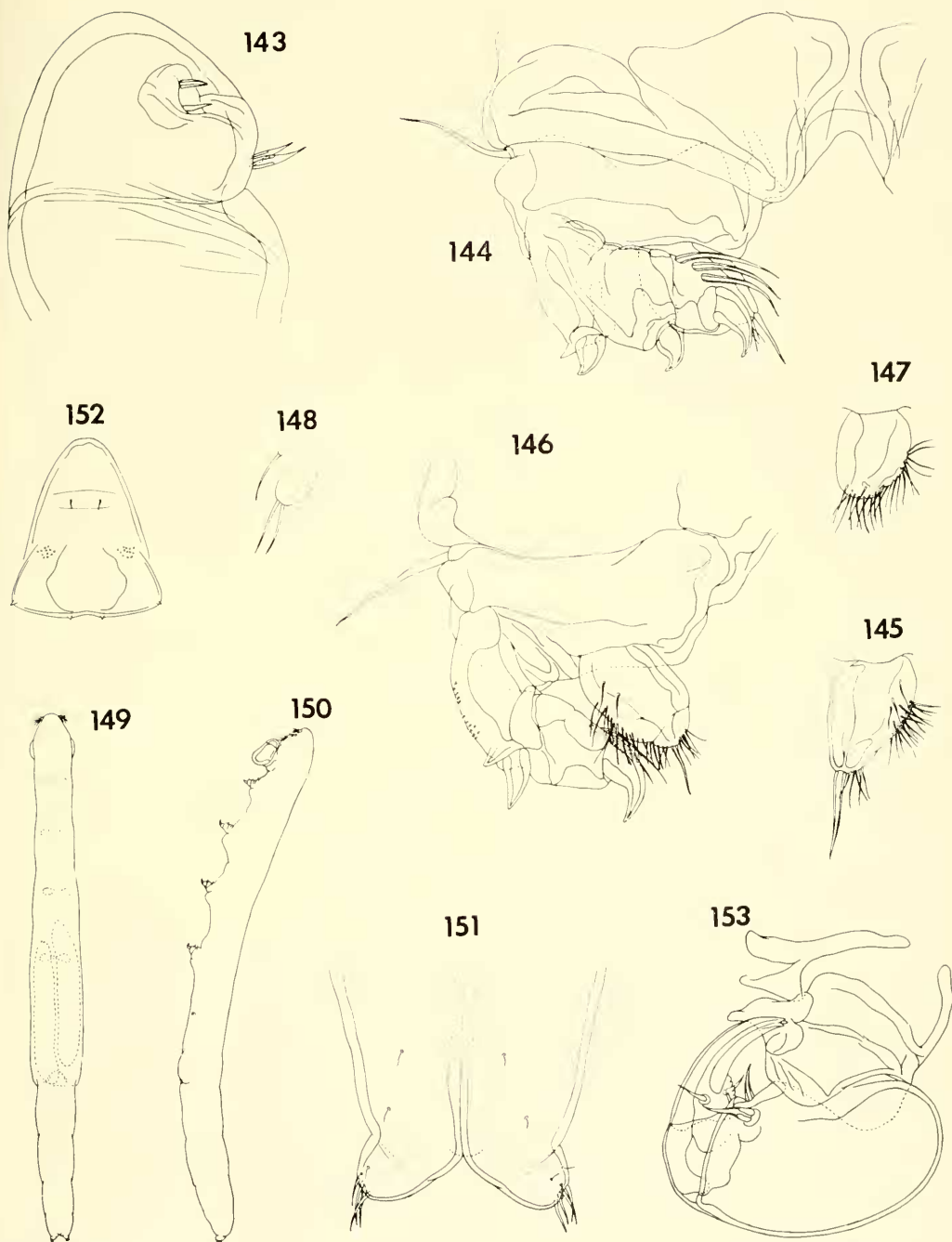


Figures 124-126. *Xarifia brevicauda* n. sp., female (continued). 124, leg 1 and intercoxal plate, anterior (C); 125, leg 3, anterolateral (C); 126, leg 5, lateral (F).

Figures 127-132. *Xarifia brevicauda* n. sp., male. 127, body, dorsal (A); 128, body, lateral (A); 129, caudal ramus, dorsal (C); 130, maxilliped, ventrointernal (G); 131, leg 5, lateral (E); 132, urosome, ventral (B).

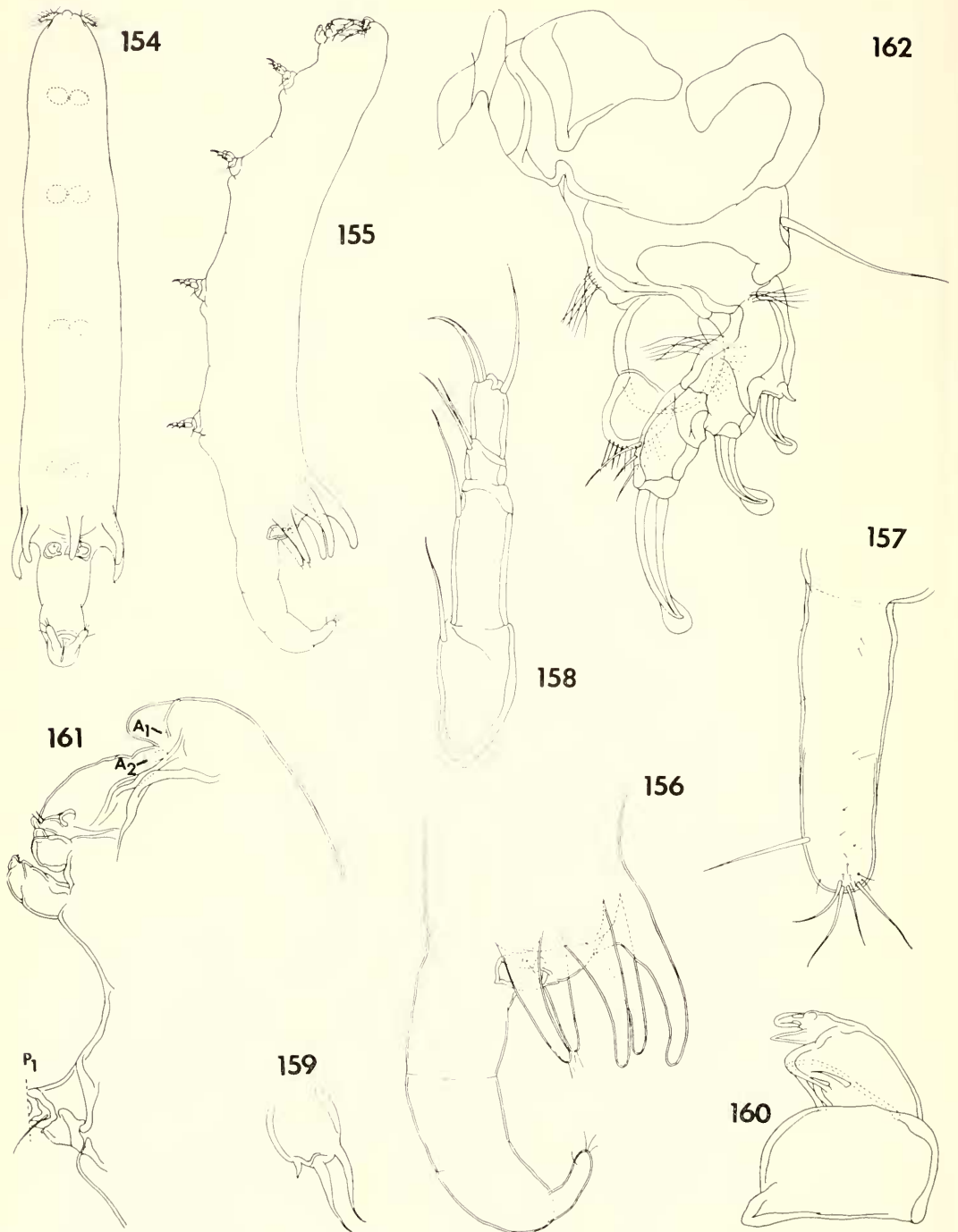


Figures 133-142. *Xaritia temnura* n. sp., female. 133, body, dorsal (A); 134, body, lateral (A); 135, urosome, lateral (H); 136, urosome, ventral (G); 137, first antenna, ventrointernal (E); 138, second antenna, ventrointernal (E); 139, anterior part of body, ventral (C); 140, mandible, ventral (E); 141, first maxilla, ventral (E); 142, second maxilla, postero-internal (E).

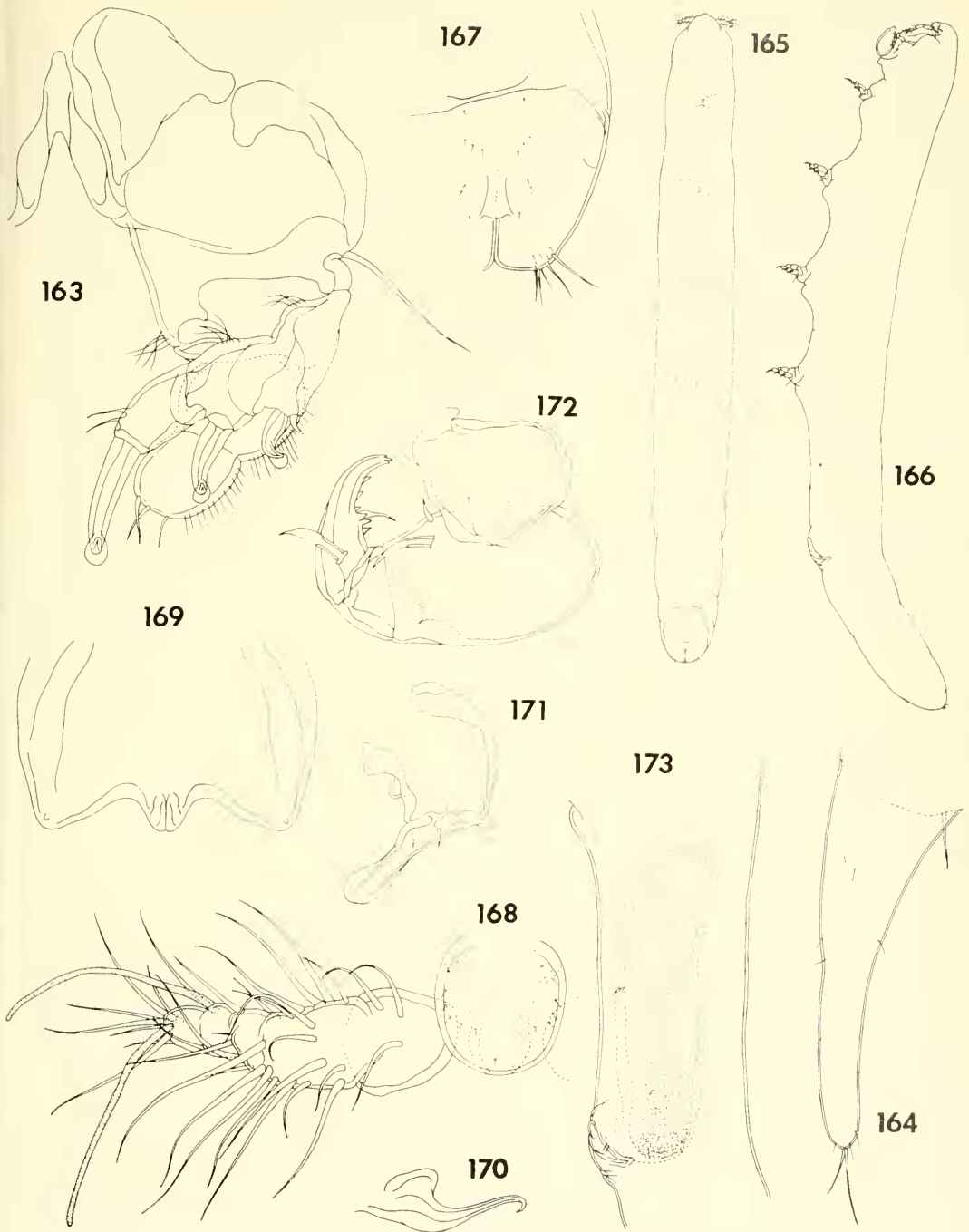


Figures 143-148. *Xarifia temnura* n. sp., female (continued). 143, maxilliped, inner (E); 144, leg 1 and intercoxal plate, posterior (E); 145, endopod of leg 1, anterior (E); 146, leg 2, anterior (E); 147, endopod of leg 3, anterior (E); 148, leg 5, lateral (D).

Figures 149-153. *Xarifia temnura* n. sp., male. 149, body, dorsal (A); 150, body, lateral (A); 151, posterior part of body, ventral (C); 152, labrum, ventral (C); 153, maxilliped, inner (C).

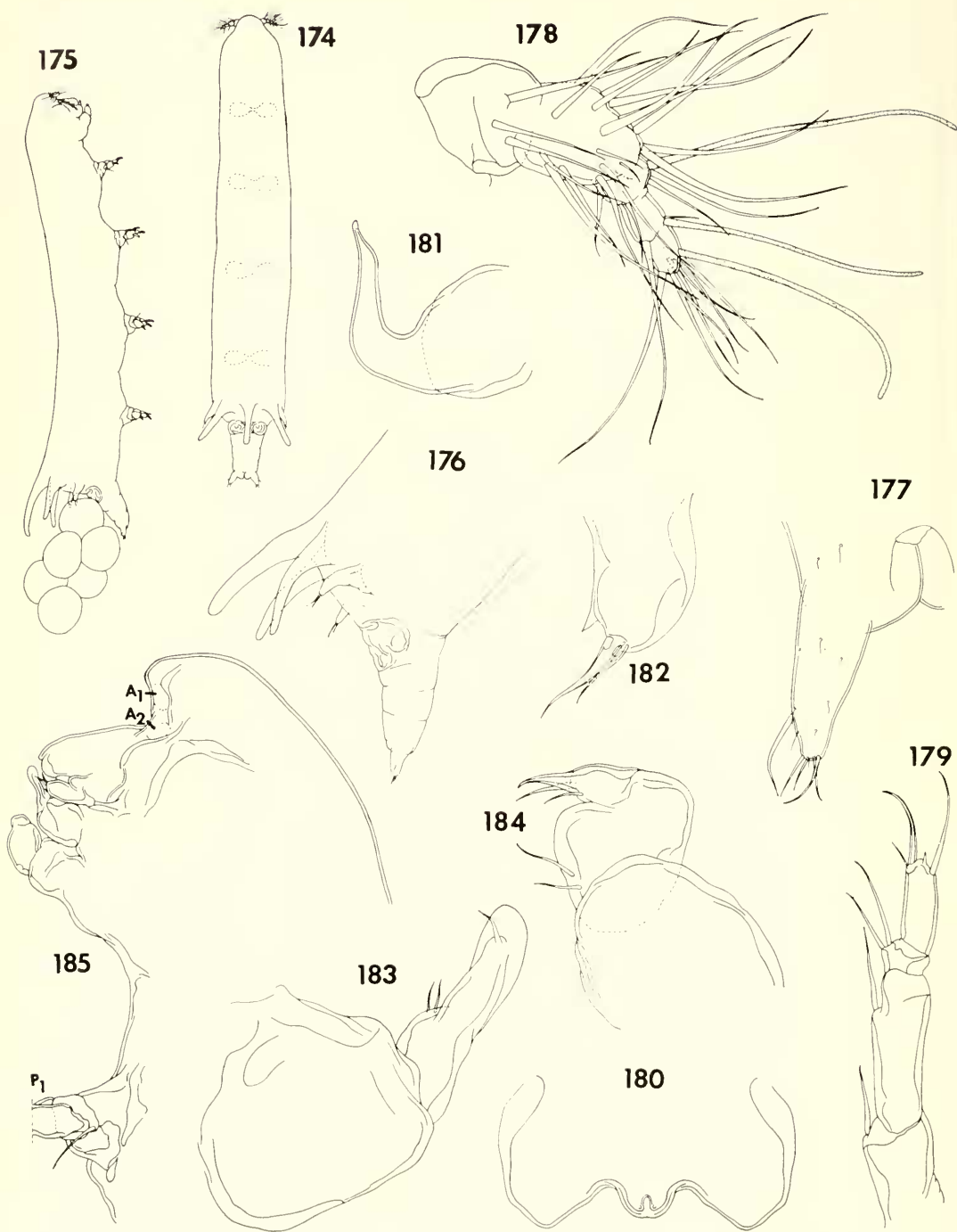


Figures 154-162. *Xaritia anomala* n. sp., female. 154, body, dorsal (I); 155, body, lateral (I); 156, urosome, lateral (H); 157, caudal ramus, dorsal (D); 158, second antenna, ventral (E); 159, first maxilla, posterior (E); 160, maxilliped, inner (E); 161, anterior part of body, lateral (G); 162, leg 1 and intercoxal plate, posterior (E).

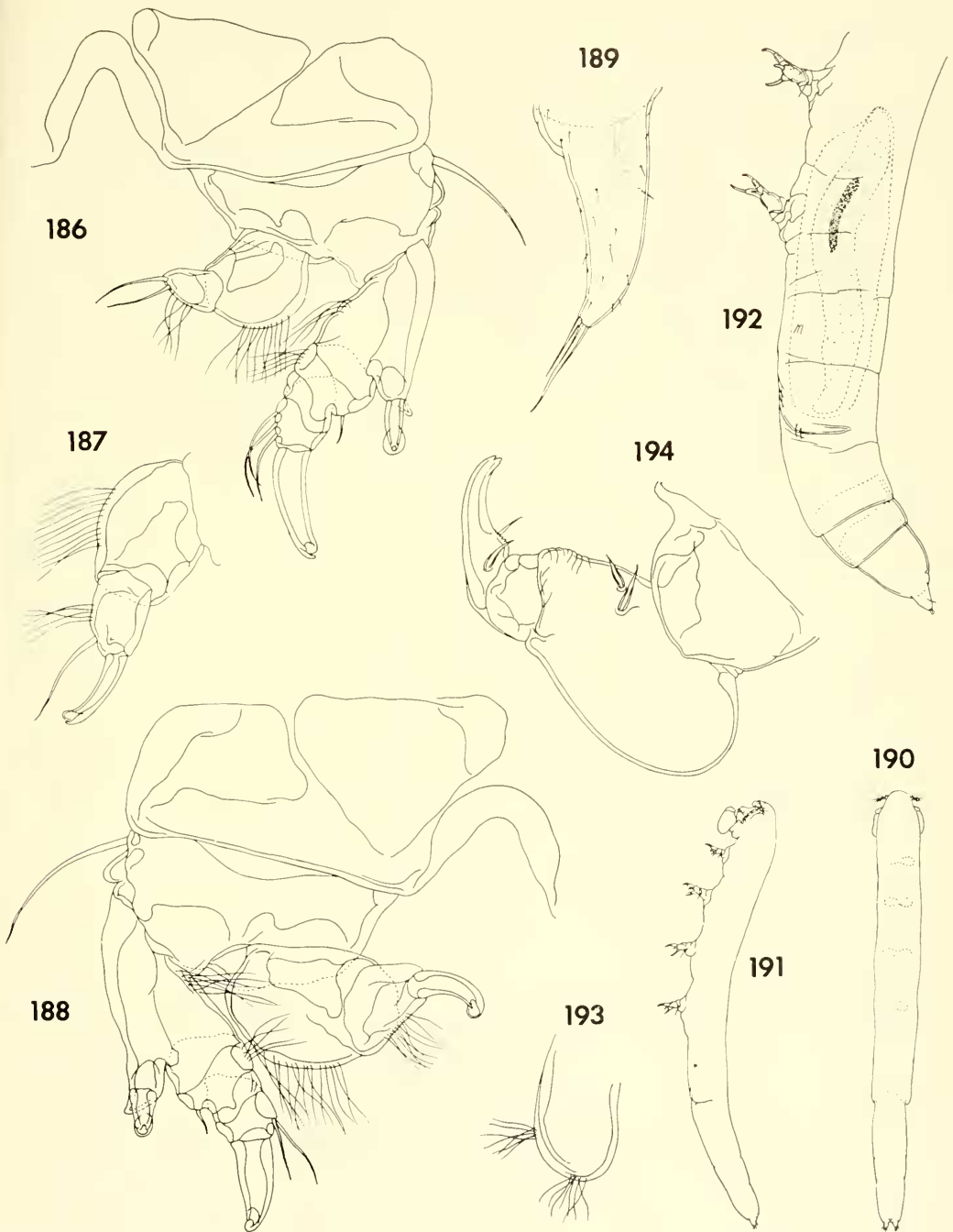


Figures 163-164. *Xarifia anomala* n. sp., female (continued). 163, leg 2 and intercoxal plate, posterior (E); 164, leg 5, lateral (C).

Figures 165-173. *Xarifia anomala* n. sp., male. 165, body, dorsal (I); 166, body, lateral (I); 167, caudal ramus, dorsal (C); 168, rostrum and first antenna, ventral (E); 169, labrum, ventral (E); 170, mandible, ventral (E); 171, second maxilla, anteroexternal (E); 172, maxilliped, medial (D); 173, portion of urosome showing leg 5, leg 6, and position of spermatophore, lateral (H).

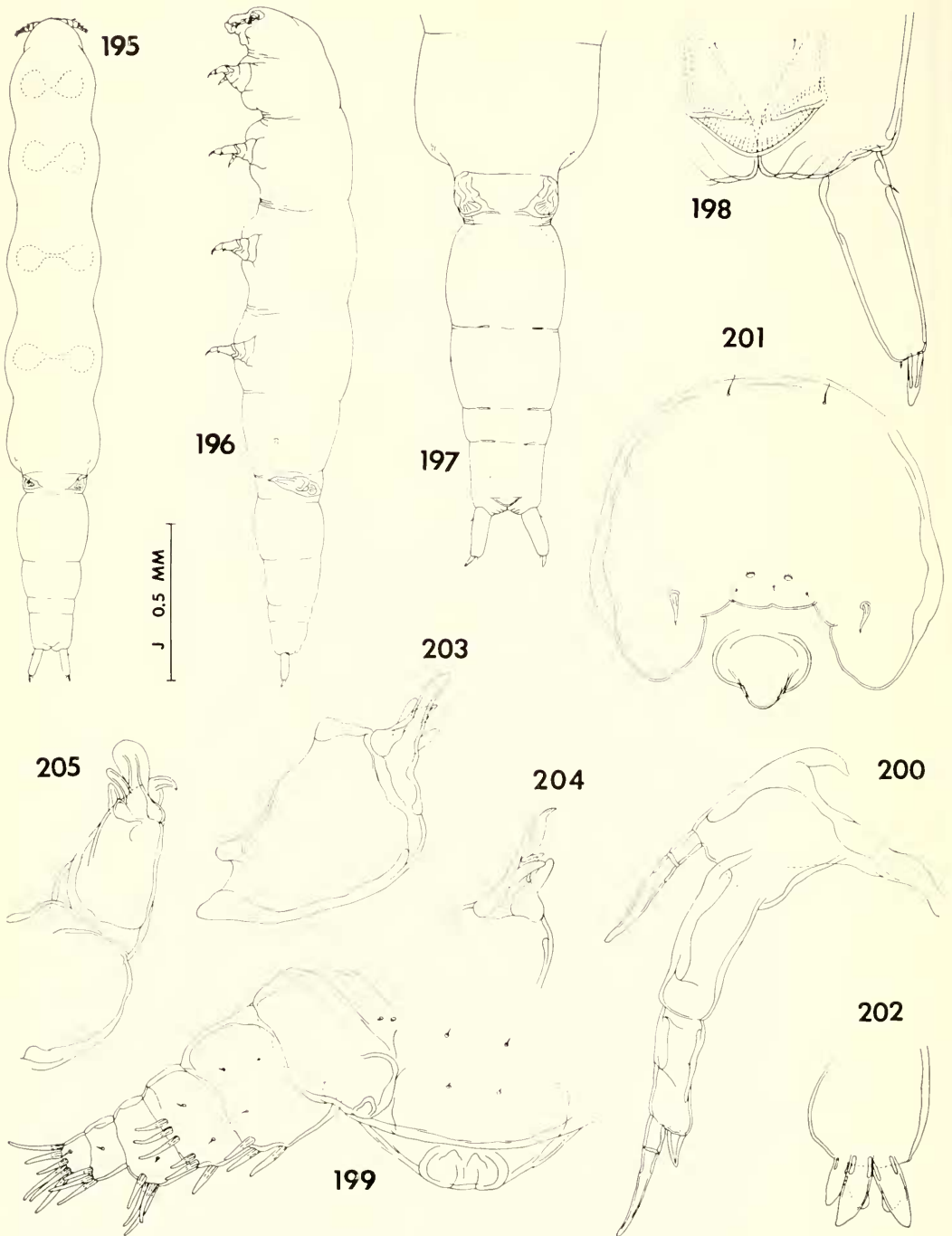


Figures 174-185. *Xaritia hamata* n. sp., female. 174, body, dorsal (A); 175, body, lateral (A); 176, urosome, lateral (B); 177, caudal ramus, dorsal (C); 178, first antenna, anterodorsal (D); 179, second antenna, ventral (D); 180, labrum, ventral (D); 181, mandible, ventral (E); 182, first maxilla, posterior (E); 183, second maxilla, posterior (E); 184, maxilliped, posterointernal (D); 185, anterior part of body, lateral (F).

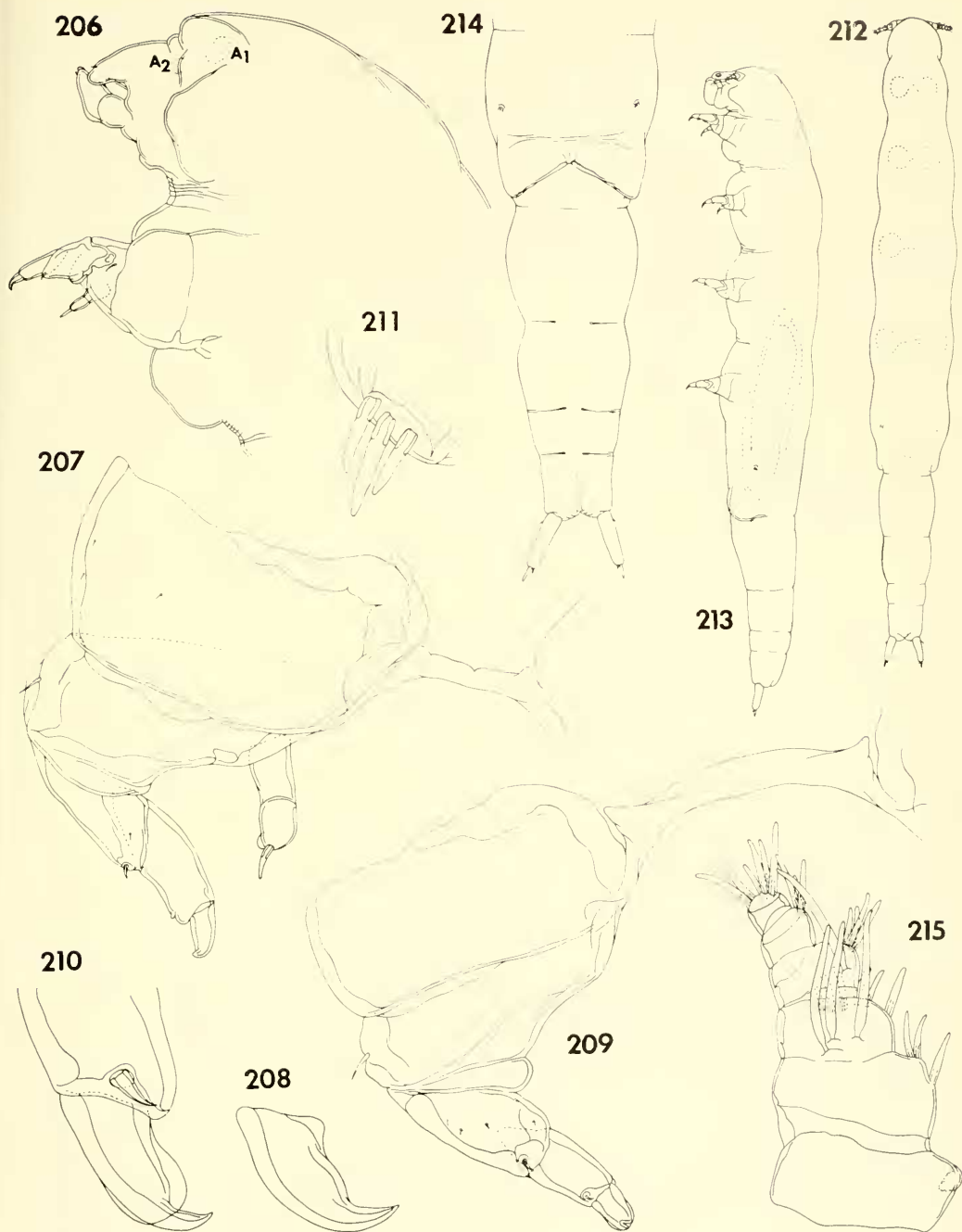


Figures 186-189. *Xarifia hamata* n. sp., female (continued). 186, leg 1 and intercoxal plate, posterior (D); 187, endopod of leg 2, posterior (D); 188, leg 3 and intercoxal plate, posterior (D); 189, leg 5, lateral (C).

Figures 190-194. *Xarifia hamata* n. sp., male. 190, body, dorsal (A); 191, body, lateral (A); 192, posterior part of body, lateral (B); 193, paragnath, ventral (E); 194, maxilliped, inner (C).

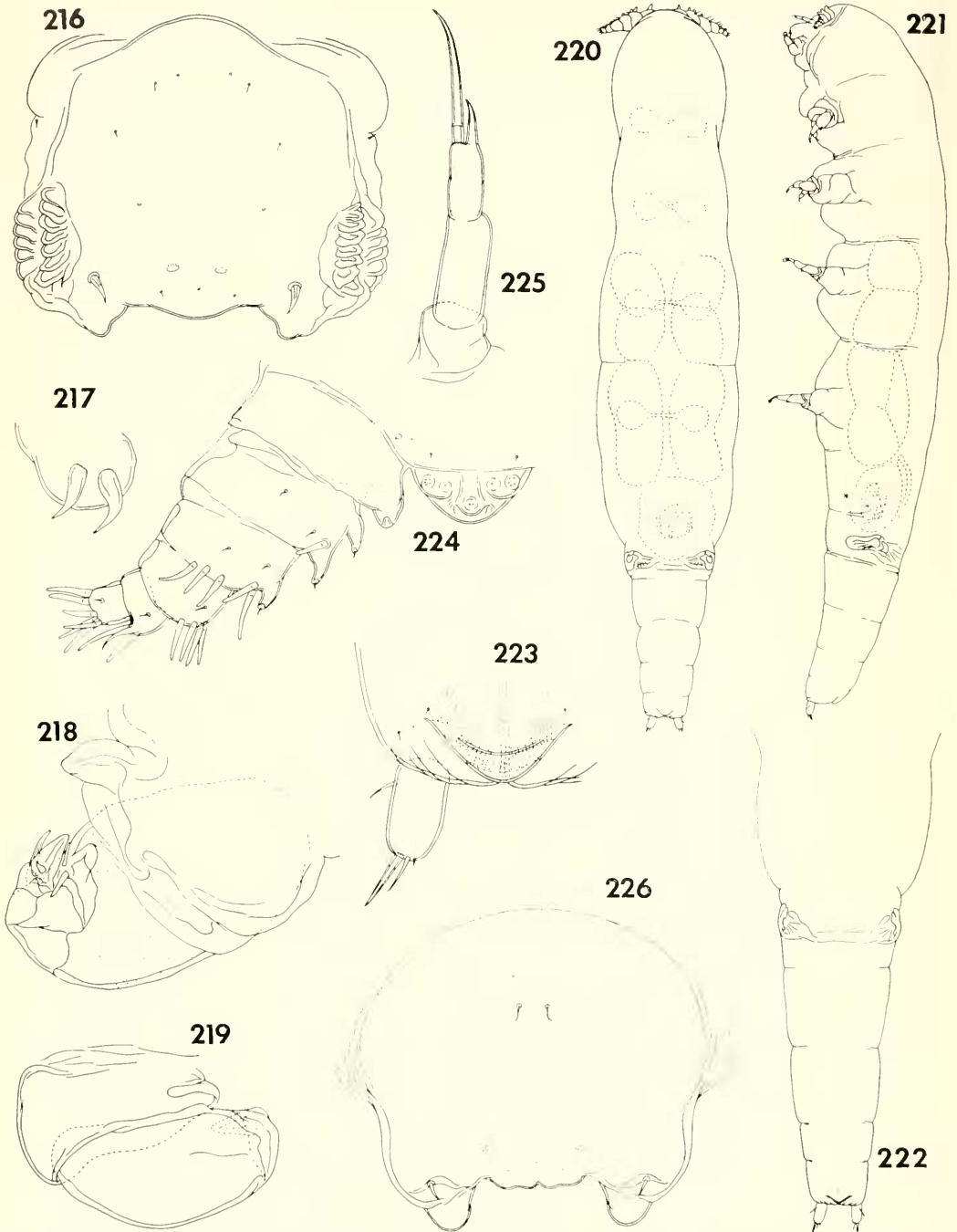


Figures 195-205. *Orstamella faviae* n. gen., n. sp., female. 195, body, dorsal (J); 196, body, lateral (J); 197, urosome, dorsal (I); 198, caudal ramus, dorsal (G); 199, rastral area and first antenna, anterior (C); 200, second antenna, outer (E); 201, labrum and median prominence behind second maxillae, anteroventral (D); 202, first maxilla, anteroventral (E); 203, second maxilla, anteroventral (E); 204, terminal portion of second maxilla, posterior (E); 205, maxilliped, anteroventral (D).

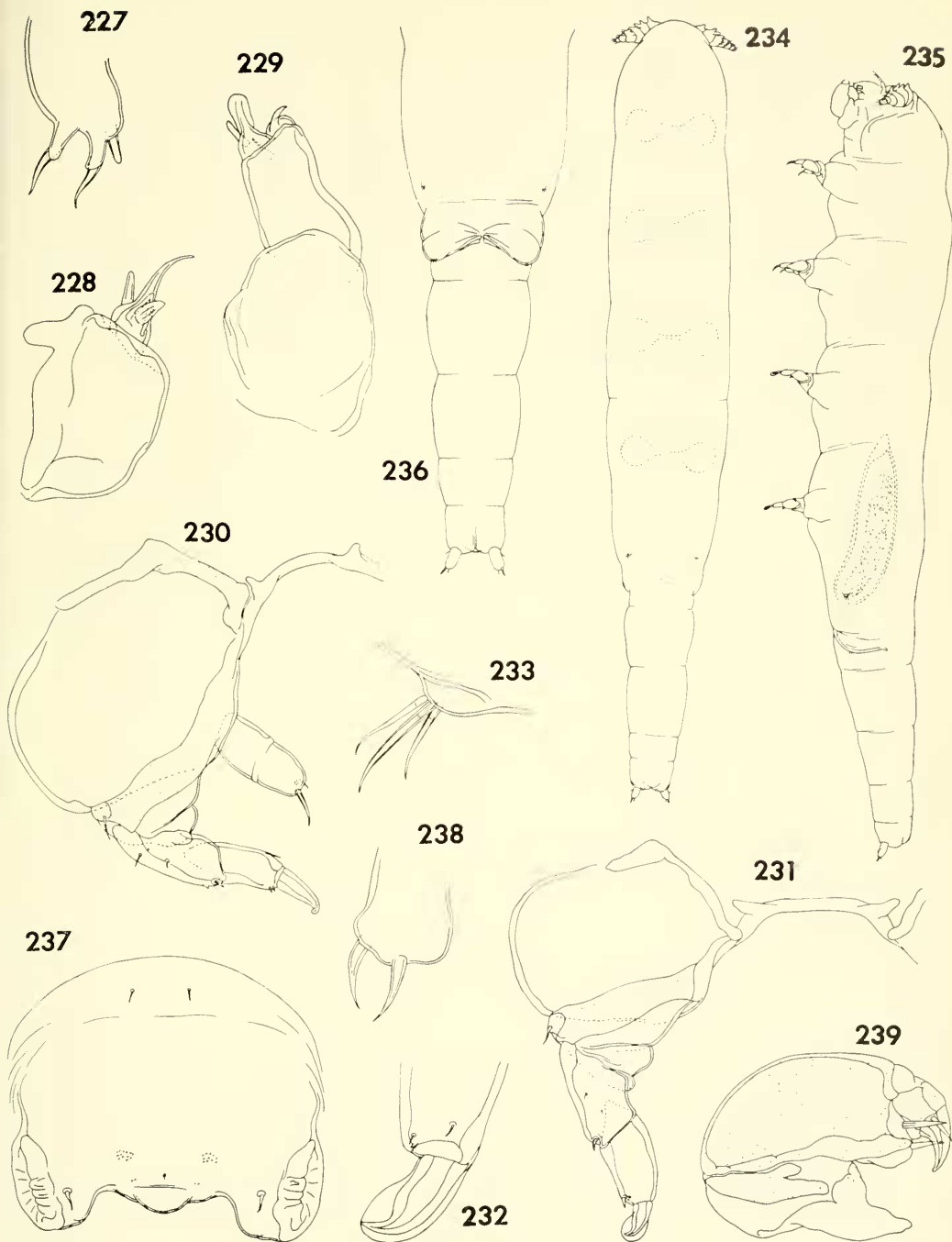


Figures 206-211. *Orstomella laviae* n. gen., n. sp., female (continued). 206, anterior part of body, lateral (H); 207, leg 1 and intercoxal plate, posterior (C); 208, terminal spine on exopod of leg 1, outer (E); 209, leg 3 and intercoxal plate, posterior (C); 210, terminal portion of exopod of leg 3, lateral (E); 211, leg 5, ventral (E).

Figures 212-215. *Orstomella faviae* n. gen., n. sp., male. 212, body, dorsal (J); 213, body, lateral (J); 214, urosome, ventral (I); 215, first antenna, posterior (C).



Figures 216-219. *Orstamella faviae* n. gen., n. sp., male (continued). 216, labrum, anteroventral (D); 217, first maxilla, anteroventral (E); 218, maxilliped, anteroventral (C); 219, maxilliped, outer (G).
 Figures 220-226. *Orstamella lobophylliae* n. gen., n. sp., female. 220, body, dorsal (I); 221, body, lateral (II); 222, urosome, dorsal (B); 223, caudal ramus, dorsal (C); 224, rastral area and first antenna, anteroventral (C); 225, second antenna, anteroventral (E); 226, labrum, anterior (D).



Figures 227-233. *Orstomella lobophylliae* n. gen., n. sp., female (continued). 227, first maxillo, ventrointernal (E); 228, second maxilla, ventrointernal (E); 229, maxilliped, outer (D); 230, leg 1 and intercoxal plate, posterior (C); 231, leg 3 and intercoxal plate, posterior (C); 232, terminal portion of exopod of leg 4, lateral (E); 233, leg 5, ventral (E). Figures 234-239. *Orstomella lobophylliae* n. gen., n. sp., male. 234, body, dorsolateral (I); 235, body, lateral (I); 236, urosome, ventral (B); 237, lobrum, anteroventral (D); 238, first maxilla, outer (E); 239, maxilliped, inner (C).