A cyclopoid copepod, *Sewellochiron fidens* n. gen., n. sp., associated with a medusa in Puerto Rico

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**ABSTRACT**

A new lichomolgid copepod, *Sewellochiron fidens* n. gen., n. sp., is described from Puerto Rico, where it is associated with the medusa *Cassiopea xamachana*.

**INTRODUCTION**

Only a few copepods are known to be associated with scyphozoan medusae. Humes (1953) reported a new harpacticoid species, *Nitocra medusaea*, from small pits in the exumbrella of *Aurelia* sp. at Portsmouth, New Hampshire. Reddiah (1968) described three new cyclopoid species of the genus *Paramacrochiron* Sewell, 1949, from medusae in southeastern India. These are *P. ennorensis* from unidentified medusae, *P. sewelli* from *Lychnorhiza malayensis* Stiasny, and *P. rhizostomae* from *Rhizostoma* sp. Recently Reddiah (1969) has described a new genus and species, *Pseudomacrochiron stockii*, from *Dactylometra quinquicirrha* L. Agassiz at Madras, India. All of Reddiah’s specimens were recovered from washings of medusae relaxed with menthol, and the exact location of the copepods on the hosts is not known. The new copepod described here was obtained after washing the medusae in slightly alcoholized sea water.

The figures have been drawn with the aid of a camera lucida. The letter after the explanation of each figure refers to the scale at which it was drawn. The abbreviations used are: R = rostrum, A₁ = first antenna, A₂ = second antenna, L = labrum, MXPD = maxilliped, and P₁ = leg 1.

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Family Lichomolgidae Kossmann, 1877

Sewellochiron n. gen.

Body cyclopiform. Rostrum rounded rather than pointed. First antenna 7-segmented. Second antenna 3-segmented, the last segment with one claw, an almost clawlike seta, and five simple setae. Labrum with two postero-ventral lobes. Mandible with a scalelike area on the convex edge of the base, flagellum long. Paragnath a simple lobe. First maxilla with four setae. Second maxilla 2-segmented. Maxilliped of the female 3-segmented, that of the male 4-segmented with one claw.

Both rami of legs 1 to 3 three-segmented. Exopod of leg 4 three-segmented, the last segment armed with III, I, 5. Endopod of leg 4 a single short segment (showing an incomplete transverse crease) armed with two terminal spines. Leg 5 with a free segment bearing terminally a spine and a seta. Male with sexual dimorphism in the last segment of the endopod of leg 1 where the formula is I, I, 4.

Near Paramacrochiron and Pseudomacrochiron. Other features as in the species described below. Associated with scyphozoan medusae.

Type and only known species: Sewellochiron fidens n. sp.

Gender neuter.

The name is a combination of Sewell (for the late R. B. Seymour Sewell) and -chiron, derived from the Greek word χελό — a hand or claw and used in names of related genera.

Sewellochiron fidens n. sp. Figs. 1—27

Type material. — 83 ♀ ♂ and 42 ♂ ♂ from 114 Cassiopea xamachana R. P. Bigelow1), in 3 m, Cayo Enrique, south of La Parguera, southwestern Puerto Rico, August 18, 1959. Holotype ♀, allotype, and 70 paratypes (47 ♀ ♂, 23 ♂ ♂) deposited in the Zoölogisch Museum, Amsterdam (ZMA Co. 101,156); 30 paratypes (20 ♀ ♂, 10 ♂ ♂) in the United States National Museum, Washington; and the remaining paratypes in the author's collection.

Female. — The body (figs. 1 and 2) is cyclopiform. The length (excluding the setae on the caudal rami) is 1.84 mm (1.78—1.95 mm) and the greatest width 0.69 mm (0.67—0.70 mm), based on 10 specimens in lactic acid. The ratio of the length to the width of the prosome is 1.51 : 1. The segment of

Figures 1—6. *Sewellochiron fiden*s n. gen., n. sp., female. 1, dorsal (A); 2, lateral (A); 3, uroscope, dorsal (B); 4, area of attachment of egg sac, dorsal (C); 5, caudal ramus, dorsal (D); 6, egg sac, with edge of uroscope, dorsal (B).
leg 1 is separated from the head dorsally and laterally by a furrow. The epimeral areas of the metasomal segments are rounded.

The segment of leg 5 (fig. 3) is 96 × 247 μ. Between this segment and the genital segment there is no ventral intersegmental sclerite. The genital segment is elongated, 319 μ long, in dorsal view its anterior two-thirds expanded laterally with rounded margins (greatest width 231 μ) merging gradually with the more slender posterior third (width here 154 μ). Mid-dorsally near the junction of the expanded and narrow parts of the segment there is a transverse crease in front of which there is a small crescentic sclerotization which protrudes slightly in lateral view (fig. 2). The areas of attachment of the egg sacs are dorsolateral in position, each area (fig. 4) bearing two naked setae about 25 μ long with a spiniform process 17 μ between them. The three postgenital segments are 83 × 135 μ, 57 × 125 μ and 104 × 133 μ from anterior to posterior. The anal segment has a row of minute spinules posteriorly on its dorsolateral and ventrolateral margins.

The caudal ramus (fig. 5) is elongated, 200 × 53 μ in greatest dimensions. The ratio of the length to the width is 3.77 : 1. The outer lateral seta is 130 μ and the dorsal pedicellate seta is 41 μ, both of them naked. The outermost terminal seta is 135 μ and the innermost terminal seta 160 μ, both haired proximally. The two long median terminal setae are 275 μ (outer) and 390 μ (inner), both naked and inserted between dorsal (smooth) and ventral (with a row of minute spinules) flaps. The longer of these two setae shows a weak joint at about mid-length. There is a minute lateral setule 5 μ long on the outer proximal area of the ramus. The dorsal and ventral surfaces of the ramus bear very small hairs.

The dorsal surface of the prosome and urosome bears minute hairs (sensilla) and refractile points; the ventral surface of the urosome is somewhat less ornamented. The ratio of the length of the prosome to that of the urosome is 1.33 : 1.

The egg sac (fig. 6) is elongated oval, 451 × 215 μ, reaching just posterior to the insertion of the caudal ramus and containing numerous eggs each about 52 μ in diameter.

The rostrum (fig. 7) is broadly triangular with a rounded tip. In lateral view (fig. 8) the rostrum is raised ventrally and is pointed rather than rounded.

The first antenna (fig. 9) is 7-segmented, 500 μ in length. The lengths of the segments (measured along their posterior non-setiferous margins) are: 39 (88 μ along the anterior margin), 133, 33, 66, 66, 50, and 60 μ respectively. The formula for the armature is: 4, 13 (5 + 8), 6, 3, 4 + 1 aesthete, 2 + 1 aesthete, and 7 + 1 aesthete, as often seen in lichomolgids. The long terminal seta is 180 μ. All the setae are naked.

The second antenna (fig. 10) is 3-segmented, with the third segment resulting from the apparent complete fusion of the original third and fourth segments. The first segment bears one seta and the second bears one seta and a few minute spinules. The third segment, 107 μ along its outer edge to the
Figures 7—12. Sewellochiron fidens n. gen., n. sp., female. 7, rostrum, ventral (E); 8, profile of rostrum (R) and labrum (L), lateral (F); 9, first antenna, dorsal (F); 10, second antenna, anterior (D); 11, labrum, ventral (D); 12, mandible, posterior (C).
seta, 94 μ along its inner edge, and 40 μ wide, bears on its inner margin three
setae and a few very small spinules and is armed terminally with a recurved
claw 101 μ along its axis and six setae, one of them stouter than the others and
almost clawlike. All the setae are naked.

The labrum (fig. 11) has two divergent hyaline posteroventral lobes.

The mandible (fig. 12) has on the convex side of the blade a scalelike region
with a row of spinules, followed by a hyaline spike, and then by a row of
toothlike serrations. The concave margin is deeply incised, with the margin
distal to the incision having a row of spinules. The long flagellum has barbed
hyaline lamellae. The paragnath (fig. 13) is a small hairy lobe. The first
maxilla (fig. 14) has four setae. The second maxilla (fig. 15) has a large un-
ornamented first segment. The second segment, with a rather swollen base,
bears a minute proximal outer spine, a posterior surficial seta with only two
inner spines, and a strongly barbed inner seta; the terminal lash is rather
short, with teeth along the convex margin and a single spine in the middle of
the concave margin. The maxilliped (fig. 16) is probably 3-segmented though
the second, third segments are indistinctly separated. The first segment is
unarmed, the second bears two inner spines, one naked, the other with a minute
spine. The third segment bears subterminally an articulated spine with one
spine, a small setule, and a spine without an articulation; terminally the
segment is prolonged as a spiniform and almost clawlike process with one
inner spine.

The area between the maxillipeds and the first pair of legs (fig. 17) is
somewhat protuberant (fig. 2); a sclerotized line connects the bases of the
maxillipeds.

Legs 1 to 4 (figs. 18, 19, 20, and 21) have 3-segmented rami, except for
the endopod of leg 4 which consists of a single segment. The armature is as
follows (the Roman numerals indicating spines, the Arabic numerals re-
presenting setae):

| P_1 coxa | 0—1 basis | 1—0 exp | I—0 | I—1 | III,1,4 |
| P_2 coxa | 0—1 basis | 1—0 exp | I—0 | I—1 | III,1,5 |
| P_3 coxa | 0—1 basis | 1—0 exp | I—0 | I—1 | III,1,5 |
| P_4 coxa | 0—1 basis | 1—0 exp | I—0 | I—1 | III,1,5 |

The inner seta on the coxa of legs 1 to 3 is long and plumose, but in leg 4
this seta is shorter (84 μ) and finely barbed. The inner margin of the basis
in all four legs is haired. The exopod of leg 4 (fig. 21) is 280 μ long, and the
endopod 125 μ, the ratio being 2.24 : 1. The endopod is considered to be
1-segmented, though the wider proximal half (width 44 μ, with hairs on both
inner and outer margins) and the narrower distal half (width 40 μ, with hairs
only on the outer margin) are set off from one another by an outer indenta-
tion and an incomplete transverse crease on the anterior surface of the seg-
ment. The two terminal fringed spines are 72 μ (outer) and 98 μ (inner). At
the insertion of each spine there is a row of minute spinules.
Figures 13—18. Sewellochiron fidens n. gen., n. sp., female. 13, paragnath, posterior (C); 14, first maxilla, posterior (C); 15, second maxilla, posterior (G); 16, maxilliped, antero-inner (G); 17, area between maxillipeds and leg 1, ventral (F); 18, leg 1 and intercoxal plate, anterior (F).
Leg 5 (fig. 22) has a long unornamented free segment of somewhat irregular form, about $130 \times 35 \mu$ in greatest dimensions. Terminally it bears an outer naked seta $64 \mu$ and an inner spine $55 \mu$, with its outer side having a proximal swelling and a distal lamella. The seta on the body near the free segment is naked.

Leg 6 is probably represented by the two setae near the attachment of each egg sac (fig. 4).

The color in life in transmitted light is slightly opaque, the eye red.

Male. — The body (fig. 23) resembles in general form that of the female. The length (not including the ramal setae) is 1.43 mm (1.28—1.50 mm) and the greatest width 0.47 mm (0.45—0.50 mm), based on 10 specimens in lactic acid. The ratio of the length to the width of the prosome is 1.55 : 1.

The segment of leg 5 (fig. 23) is $65 \times 146 \mu$. Between this segment and the genital segment there is no ventral intersegmental sclerite. The genital segment is $286 \times 270 \mu$, only a little longer than wide. The four postgenital segments are $70 \times 99 \mu$, $52 \times 91 \mu$, $34 \times 83 \mu$, and $65 \times 86 \mu$ from anterior to posterior.

The caudal ramus resembles that of the female, but is smaller, $143 \times 44 \mu$.

The body is ornamented with minute hairs and refractile points as indicated in figure 23. The ratio of the length of the prosome to that of the urosome is 1.07 : 1.

The rostrum is like that of the female.

The first antenna is similar to that of the female, but three long aesthetes are added (fig. 23), two on the second segment, and one on the fourth segment, so that the formula is: $4, 13 + 2$ aesthetes, $6, 3 + 1$ aesthete, $4 + 1$ aesthete, $2 + 1$ aesthete, and $7 + 1$ aesthete.

The second antenna, labrum, mandible, paragnath, first maxilla, and second maxilla resemble those of the female. The maxilliped (fig. 24) is elongated and 4-segmented, assuming that the proximal half of the claw represents a fourth segment. The second segment bears two setae, one naked, the other barbed, and a row of spinules. The claw is $180 \mu$ along its axis, shows a division about midway, and bears proximally two very unequal setae, the larger one finely barbed distally.

Legs 1 to 4 are segmented as in the female and have similar armature and ornamentation, except for leg 1 where the last segment of the endopod (fig. 25) shows sexual dimorphism, its formula being $1,1,4$, instead of $1,5$ as in the female.

Leg 5 (fig. 26) is smaller than in the female, its free segment being $53 \times 17 \mu$, with the terminal seta $50 \mu$ and the spine $40 \mu$.

Leg 6 (fig. 27) consists of a posteroverentral flap on the genital segment, bearing two naked setae $53 \mu$ and $60 \mu$ and a small spiniform process about $8 \mu$.

The spermatophore was not observed.

The color in life is similar to that of the female.
Figures 19—22. *Sewellochiron fidens* n. gen., n. sp., female. 19, leg 2, anterior (F); 20, endopod of leg 3, anterior (F); 21, leg 4 and intercoxal plate, anterior (F); 22, leg 5, dorsal (G).
(The specific name *fidens*, from Latin = fearless, alludes to the presence of this copepod on a medusa which is said to include small crustaceans in its food).

**DISCUSSION**

The new genus is close to *Paramacrochiron* Sewell, 1949, and *Pseudomacrochiron* Reddiah, 1969. *Paramacrochiron* was proposed by Sewell as a subgenus of *Macrochiron* Brady, 1872, to include those species with the endopod of leg 4 composed of a single segment. Of the five species which he placed in *Paramacrochiron*, only one, *P. maximum* (Thompson & A. Scott, 1903) properly belongs there, as Stock (1957) has pointed out. The rest belong in other genera. Thus, *Pseudanthessius chelifer* Thompson & A. Scott, 1903, is *Macrochiron cheliferum* (Thompson & A. Scott, 1903). *Pseudanthessius parvus* A. Scott, 1909, *Macrochiron malayense* Sewell, 1949, and *Macrochiron ornatum* Krishnaswamy, 1952, have been placed in *Pseudomacrochiron*, along with *Pseudomacrochiron stocki* Reddiah, 1969. To this genus *Pseudanthessius fucicolus* T. Scott, 1912, should perhaps be added.

Reddiah (1968) has given a diagnosis of the genus *Paramacrochiron*, and included in it the type species, *P. maximum* (Thompson & A. Scott, 1903), and his three new species, *P. ennorese*, *P. sewelli*, and *P. rhizostomae*.

*Sewellochiron* differs from *Paramacrochiron* mainly in its 3-segmented second antenna, in the formula III,1,5 (instead of II,1,5 as in *Paramacrochiron*) for the last segment of the exopod of leg 4, and in the endopod of leg 4 in the female being much shorter than the exopod (ratio 1 : 2.24).

The new genus differs also from *Macrochiron* Brady, 1872, which has a pointed or needlelike tip on the rostrum, the last segment of the 3-segmented second antenna with either two pectinate claws or one pectinate claw and one clawlike seta, the maxilliped of the female often geniculate with the first and second segments usually elongated, and the endopod of leg 4 a single segment, a weakly divided segment, or 2-segmented.

*Sewellochiron* differs from *Pseudomacrochiron* which has a 4-segmented second antenna with two claws, lacks paragnaths, and has an armature of II,1,5 on the last segment of the exopod of leg 4.
Figures 23—27. *Sewellochiron fidens* n. gen., n. sp., male. 23, dorsal (B); 24, maxilliped, inner (D); 25, endopod of leg 1, anterior (D); 26, leg 5, dorsal (G); 27, leg 6, ventral (D).
The distinctions among *Sewellochiron*, *Paramacrochiron*, *Pseudomacrochiron*, and *Macrochiron* may be summarized as follows:

<table>
<thead>
<tr>
<th></th>
<th><em>Sewellochiron</em></th>
<th><em>Paramacrochiron</em></th>
<th><em>Pseudomacrochiron</em></th>
<th><em>Macrochiron</em></th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of segments in $A_2$</td>
<td>3</td>
<td>4</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>Claws on last segment of $A_2$</td>
<td>1 claw</td>
<td>1 claw</td>
<td>2 claws</td>
<td>2 pectinate claws, or 1 such claw and 1 clawlike seta</td>
</tr>
<tr>
<td>Rostrum</td>
<td>rounded rather than pointed</td>
<td>undescribed</td>
<td>rounded ?</td>
<td>pointed or needlelike</td>
</tr>
<tr>
<td>Formula of last segment $P_4$ exp</td>
<td>III, I, 5</td>
<td>II, I, 5</td>
<td>II, I, 5</td>
<td>II, I, 5 or III, I, 5</td>
</tr>
<tr>
<td>Number of segments in $P_4$ exp</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1 or 2</td>
</tr>
<tr>
<td>Length of $P_4$ exp of $Q$ in relation to exp</td>
<td>much shorter than exp, ratio 1 : 2.24</td>
<td>nearly as long as exp</td>
<td>much shorter than exp</td>
<td>much shorter than exp</td>
</tr>
</tbody>
</table>

The copepods associated with medusae may be listed as follows:
*Nitocra medusaea* Humes, 1953 from *Aurelia* sp., New Hampshire
*Paramacrochiron ennorens* Reddiah, 1968 from unidentified medusae, Madras, India
*Paramacrochiron sewelli* Reddiah, 1968 from *Lychnorhiza malayensis* Stiasny, Madras
*Paramacrochiron rhizostomae* Reddiah, 1968 from *Rhizostoma* sp., Gulf of Manaar, India
*Pseudomacrochiron stocki* Reddiah, 1969 from *Dactylometra quinquicirrha* L. Agassiz, Madras
*Sewellochiron fidens* n. sp. from *Cassiopea xamachana* R. P. Bigelow, Puerto Rico.

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