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Cymbasoma californiense, a new monstrilloid (Crustacea: Copepoda: Monstrilloida) from Baja California, Mexico

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Abstract.—*Cymbasoma californiense* is described from three adult females collected during three cruises carried out in an area adjacent to Bahía Magdalena, a large coastal system on the southwest coast of the Baja California Peninsula, and in the southern Gulf of California. The new species is very closely related to at least three other *Cymbasoma* (*C. longispinosum* (Bourne) and its allies), but can be distinguished by a combination of features including: the presence of cuticular striations on the forehead, cephalothorax, and genital somite; relatively long antennules; the structure of the fifth legs, and the relative length of the ovigerous spines. *Cymbasoma californiense* is the first species of this genus recorded in the Californian region and the Eastern Tropical Pacific.

Monstrilloids are protelean parasitic copepods which are free-living only as first nauplii and adults (Raibaut & Trilles 1993). The first nauplius is the infective stage, but later stages complete their development as endoparasites of benthic organisms such as polychaetes and prosobranch molluscs. Adults are free-swimming, exclusively reproductive, and have no feeding appendages (Isaac 1975; Davis 1984).

The number of described species has been estimated as about 90 (Grygier 1994a), and they are grouped into three recognized genera (*Monstrilla*, *Monstrillopsis*, and *Cymbasoma*). The generic nomenclature of the group is still unclear, and efforts have been made to solve this problem, particularly with regard to the genus *Cymbasoma* (Grygier 1994a, 1997). This genus contains now about 57 described species, with about half of them being described under the invalid genus name *Thaumaleus* (Razouls 1996).

There are several (six) records of monstrilloid copepods in the Northeastern Pacific region (Park 1967, Grygier 1995, Razouls 1996). However, only three species of

monstrilloid copepods have been recorded in lower latitudes, such as the California region or the Eastern Tropical Pacific. All three regional records are of the genus *Monstrilla*. *Monstrilla capitellicola* Hartman, 1961 was recorded at La Jolla Canyon as a parasite of a polychaete of the genus *Capitella* (Hartman 1961), and was described upon V stage copepodids. *Monstrilla spinosa* Park, 1967, originally described from the Strait of Georgia, was recorded by Suárez-Morales & Vásquez-Yeomans (1996) off Bahía de Todos Santos, Baja California, and *M. gibbosa* Suárez-Morales & Palomares-García, 1995 was collected on the southeastern coast of the Baja California Peninsula (Suárez-Morales & Palomares-García 1995).

As part of a survey of the main coastal systems along the southern portion of the Baja California Peninsula, plankton samples were collected at Bahía de Magdalena, a large bay located on the western coast. Our taxonomic analysis of the copepods in the samples revealed the presence of several monstrilloids which turned out to belong to an undescribed species. The description of

the new species is presented herein following the standards set by Grygier & Ohtsuka (1995) for descriptions of monstilloid copepods.

Materials and Methods

Plankton samples were collected during the BAMA8611, BAMA9710, and CERRALVO9609 cruises. The first two were carried out in Bahía Magdalena (BAMA), a large coastal system on the southern portion of the western coast of the Baja California Peninsula, Mexico. The other cruise took place in the southern portion of the Gulf of California, along the southeastern coast of the Baja California. One female of the same previously undescribed species of monstilloid copepod as captured during each of the three cruises: one at station K2 (BAMA9710), on 27 October 1997, another at station R2 (BAMA9611), on 5 February 1996, and the third was collected at station SIIG49 (CERRALVO9609), 20 September 1996 (Fig. 1). Samples were collected during surface hauls with a standard plankton net (0.333 mm mesh-size). Zooplankton was fixed with a buffered formalin solution. Monstilloid copepods were sorted and transferred to 70% ethanol. Observations were made under a Zeiss microscope and drawings were made with the aid of a camera lucida. Standard terminology for copepod morphology (Huys & Boxshall 1991) and for monstilloid antennular armature (Grygier & Ohtsuka 1995) was followed.

Order Monstilloida

Family Monstilloidae Dana, 1849

Cymbasoma Thompson, 1888

Cymbasoma californiense, new species,
Suárez-Morales

Material examined.—Holotype, 2.1 mm, adult female, undissected, ethanol-preserved. Sta. K2 (coordinates in decimal notation: 24.69°N, 112.07°W) BAMA9710 cruise, Bahía Magdalena, South Baja California, Mexico, 27 Oct 1997. Vial deposited in the Collection of Crustacea, National

Museum of Natural History, Smithsonian Institution, Washington D.C., under number USNM-261422. Paratype adult female, partially dissected, permanent slide, mounted in CMC. Sta. SIIG49 (24.27°N, 109.85°W) CERRALVO9609 cruise, Isla Cerralvo, Southern Gulf of California, Mexico, 20 Sep 1996. Deposited in the NMNH, USNM-261422. Paratype adult female, total length: 2.03 mm, ethanol-preserved. Station R2 (24.41°N, 111.65°W), BAMA8611 cruise, Bahía Magdalena, Baja California Sur, Mexico, 5 Feb 1986. Vial deposited in the Zooplankton Collection of El Colegio de la Frontera Sur Unidad Chetumal, México, under number ECO-CH-Z-00369.

Type locality.—Bahía Magdalena, southern portion of the eastern coast of the Baja California Peninsula, Mexico. Water column.

Etymology.—The species is named after the Californian region in which this species was collected.

Description of female.—Average body length of 3 individuals, 2.1 mm measured from forehead to posterior margin of anal somite. Cephalothorax (incorporating first pedigerous somite) accounting for almost 65% of total body length (Fig. 2A, B). Ventral margin of anteriormost portion of cephalothorax slightly curved. Oral papilla as in Fig. 2A, lying midventrally 0.21 of way back along cephalothorax. Forehead with strong cuticular striations mainly between antennule bases, and, more dorsally, a circular, spiral pattern with two anterior and two posterior whorls, present in all the individuals. Nauplius eye present, weakly developed, ocelli slightly pigmented with rounded shape (Fig. 3E). Pair of low bumps on ventral side of cephalothorax between antennule bases and oral papilla, surrounded by circles with wrinkles arranged in spiral-shaped pattern. Cuticular ornamentation also on lateral posterior margin of cephalothorax: clear vertical striations (Fig. 2B). Antennules four-segmented, armed with 0, I; 1, V; 2, I; 10, VII setae (Arabic numbers) and spines (Roman

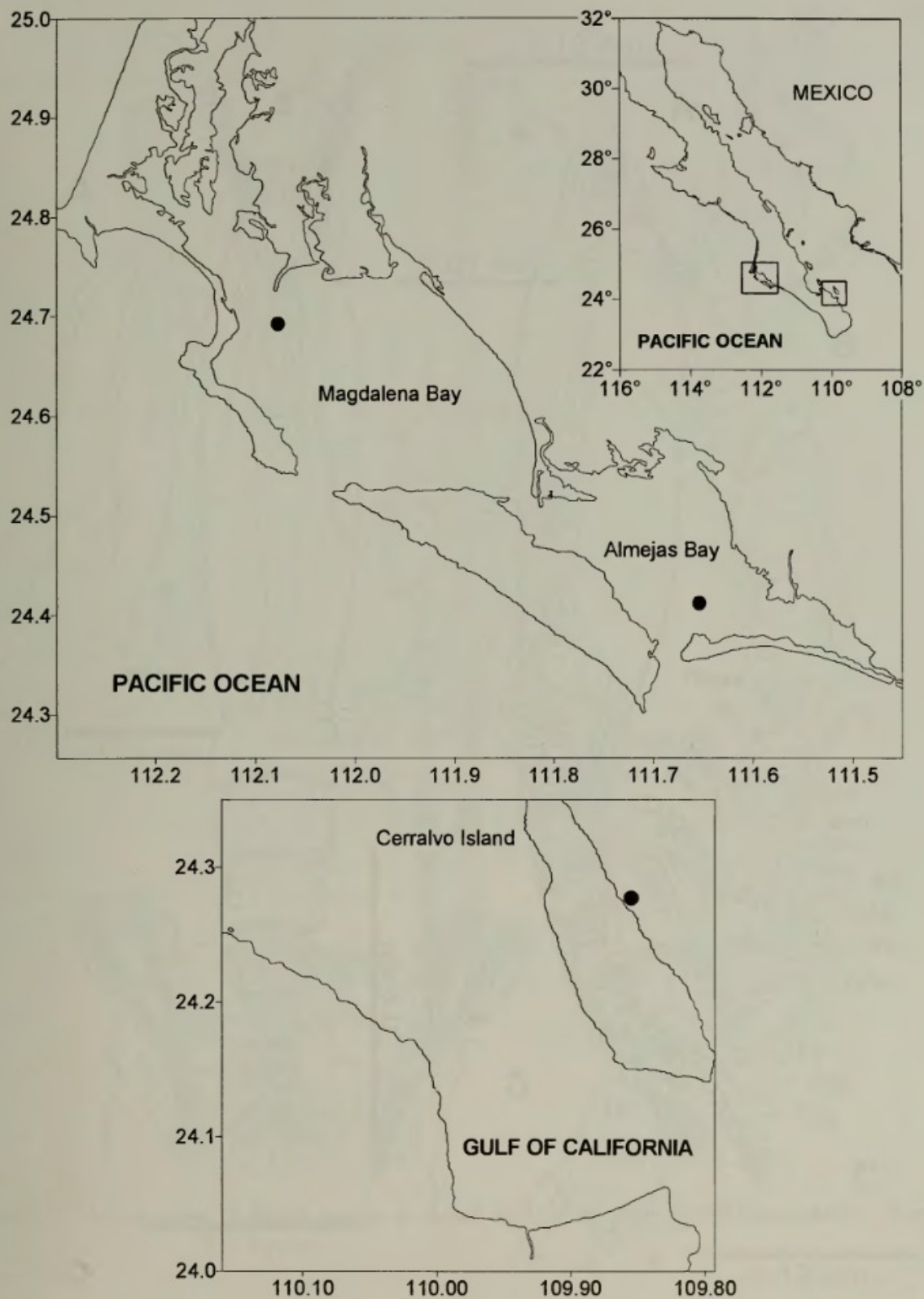


Fig. 1. Study area showing the sites in which specimens of the new species were collected.

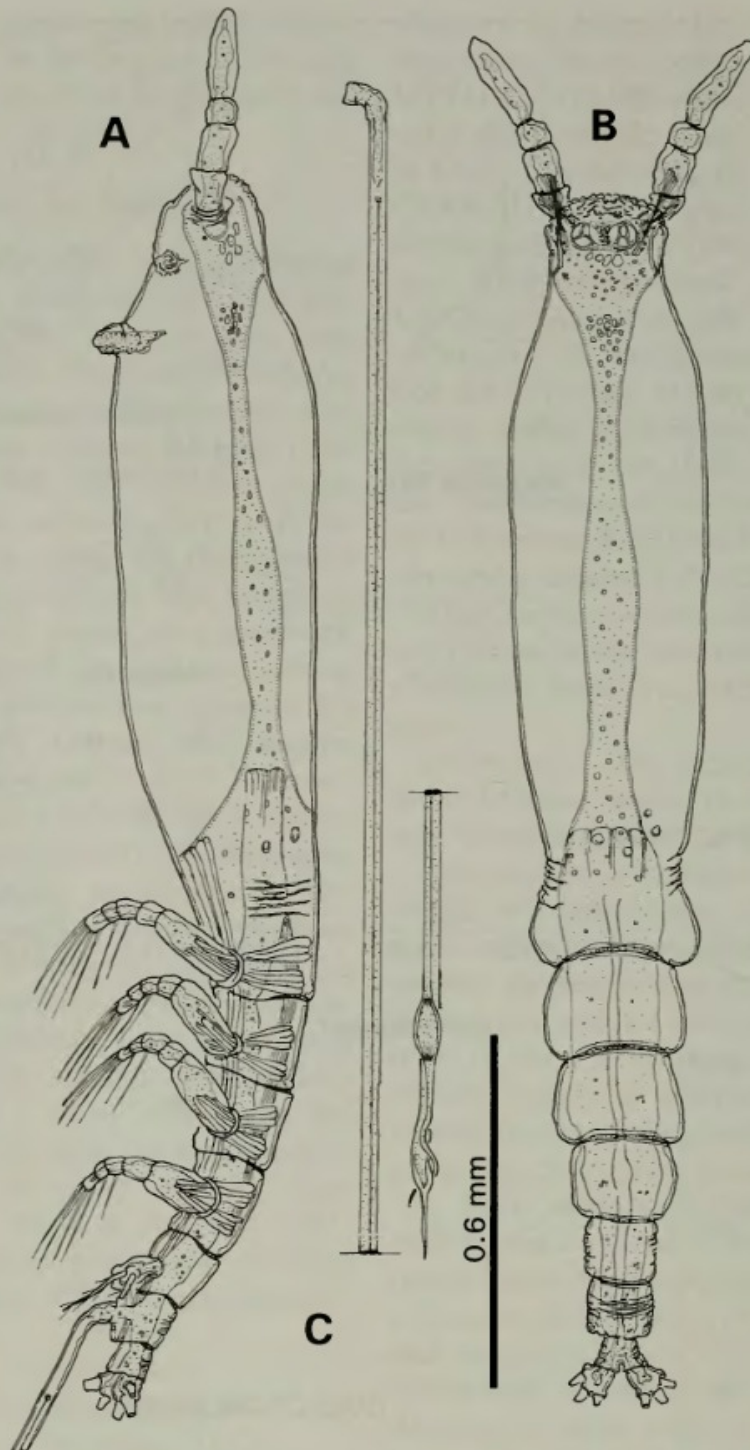


Fig. 2. *Cymbasoma californiense* n. sp., holotype female. A. habitus, lateral. B. habitus lateral. C. ovigerous spine.

numbers) (Fig. 3B, C). Terminal two spines asymmetrical, forming chela-like structure. Last segment with one small aesthetasc on distal margin, large aesthetasc (4aes) on proximal outer margin. Most spines and setae of general pattern de-

scribed by Grygier & Ohtsuka (1995) present (Fig. 3C). Only setae b5 and b6 missing on last segment of right and left antennules, setae b1–4 unbranched. Ratio of lengths of antennule segments: 11.3 : 23.1 : 14.3 : 51.3 = 100. Antennule slightly lon-

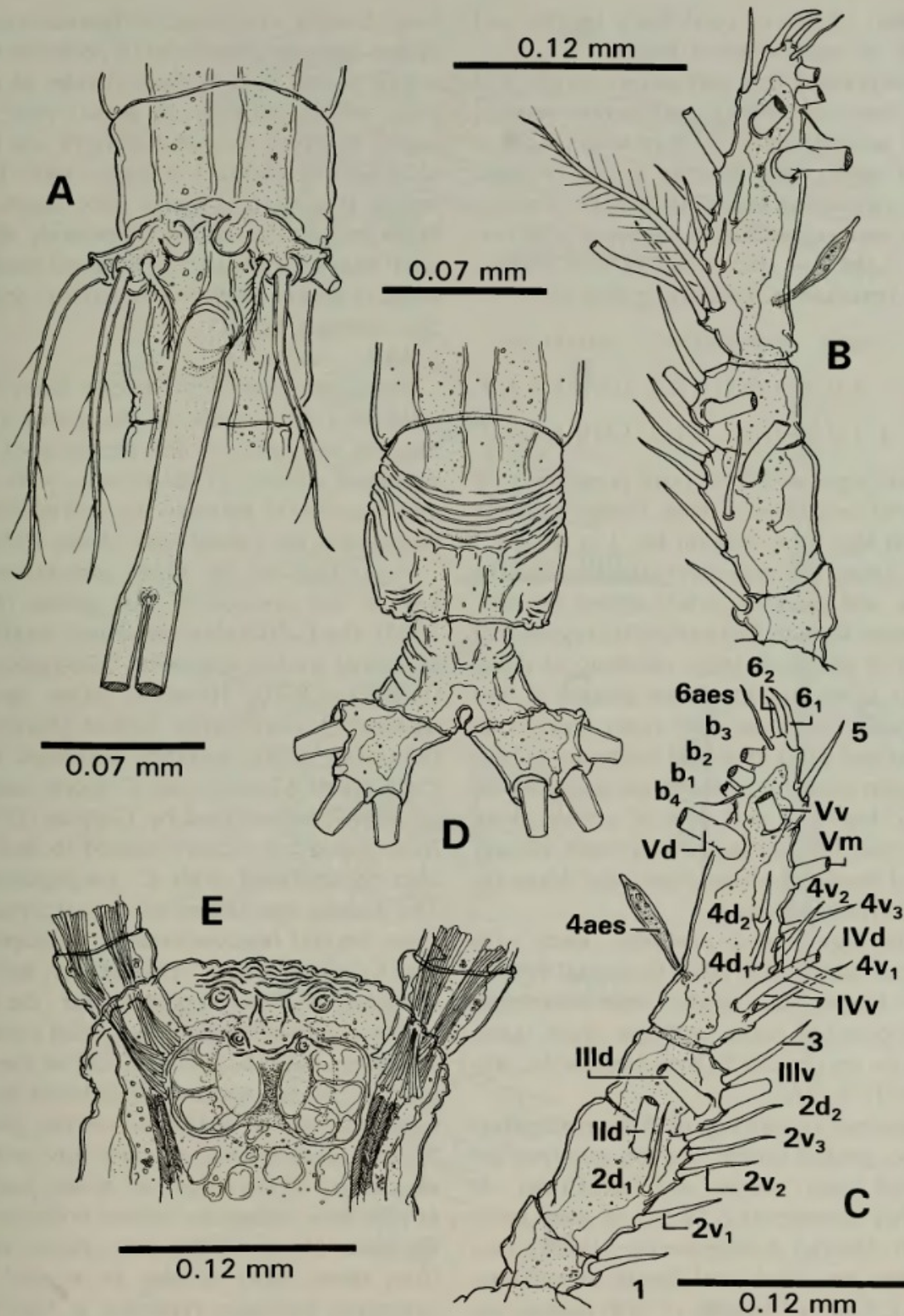


Fig. 3. *Cymbasoma californiense* n. sp., holotype female. A. genital complex and fifth legs, ventral. B. right antennule, dorsal. C. left antennule, dorsal, with armature following the nomenclature of Grygier & Ohtsuka (1995). D. urosome and furcal rami, dorsal. E. forehead, dorsal.

ger than 17.5% of total body length, and 25.5% of cephalothorax length.

Incorporated first pedigerous somite and three free succeeding pedigerous somites (latter accounting for 22% of total length in dorsal view) each bearing a pair of biramous swimming legs (Fig. 4A–D). Endopodites and exopodites of legs 1–4 triarticulated. Legs 1–4 decreasing in size posteriorly. Armature of swimming legs as:

	basis	endopodite	exopodite
leg 1	1-0	0-1; 0-1; 1, 2, 2	I-1; 0-1; I, 1, 3
legs 2–4	1-0	0-1; 0-1; 1, 2, 2	I-1; 0-1; I, 2, 3

Basis separated from coxa posteriorly by diagonal articulation, with lateral hair-like seta on legs 1–4; seta on leg 3 at least 1.5 times longer and noticeably thicker than the others, and plumose, while others are simple. Inner seta on first exopodite segment of legs 1–4 plumose, long, reaching to distal margin of endopodite. Inner margin of first endopodal segments and outer margin of second and third exopodal segments of legs 1–4 with short hairs. Outer exopodal apical seta of legs 1–4 with row of setules along inner side, but bearing row of small, closely spaced denticles along outer side. Most setae biserially plumose.

Fifth legs joined medially; each with rounded endopodal lobe. Exopodal lobe 2 times longer than wide, with two long, equal plumose setae, and one short inner, plumose seta, about 28% as long as the other two (Fig. 3A).

Urosome consisting of fifth pedigerous somite, genital double somite, one free abdominal (anal) somite, and furcal rami, altogether representing 14.3% of total body length. Genital double-somite slightly longer than one-third total length of urosome (35%). Ratio of lengths of fifth pedigerous somite, genital double somite, and free abdominal somite: 37.5:35.5:26.6 = 100. Genital somite with strong transverse cuticular wrinkles on lateral margins and dorsal surface (Fig. 3D). Medial portion of genital double somite moderately swollen, bearing

long, basally conjoined, ovigerous spines. Spines separate from level of posterior margin of furcal rami. Spines slender at their base, swollen distally, in dorsal view, left one of holotype shorter than right one (Fig. 4E). Spines about 1.4 times total body length (Fig. 2C). Caudal rami short, 1.2 times longer than wide, moderately divergent, bearing three strong, terminal setae, as usual in genus. Middle seta slightly thicker than others (Fig. 3D).

Male.—unknown.

Remarks.—The new species from Baja California is assigned to the genus *Cymbasoma* by virtue of the presence of two urosomal somites in the female, with only one free somite between the genital double somite and the caudal rami (Isaac 1975).

According to the most comprehensive key to the species of this genus (Isaac 1975), the Californian specimens would be identified as females of *C. longispinosum* (Bourne, 1890). However, other species such as *C. chelemense* Suárez-Morales & Escamilla, 1997, recently described from the Gulf of Mexico, and *C. morii* Sekiguchi, 1982, redescribed by Grygier (1994b) from Japan are closely related to and can also be confused with *C. longispinosum*. The female specimens of *C. californiense* share several features with *C. longispinosum*, *C. morri*, and *C. chelemense*, such as the relatively long cephalothorax, the general structure of the fifth legs, with a rounded endopodal lobe, the position of the oral papilla, the antennule/cephalothorax length ratio, the dorsal striations on the genital double segment, the swollen tips and the asymmetry of the ovigerous spines, and relatively long ovigerous spines conjoined at the base. However, the new species differ from these other species in several key structures generally regarded as important in monstilloid taxonomy, such as the morphological details of the fifth legs, the structure of the genital complex, and the body proportions.

In the females of *C. californiense* the cephalothorax represents 65% of the total

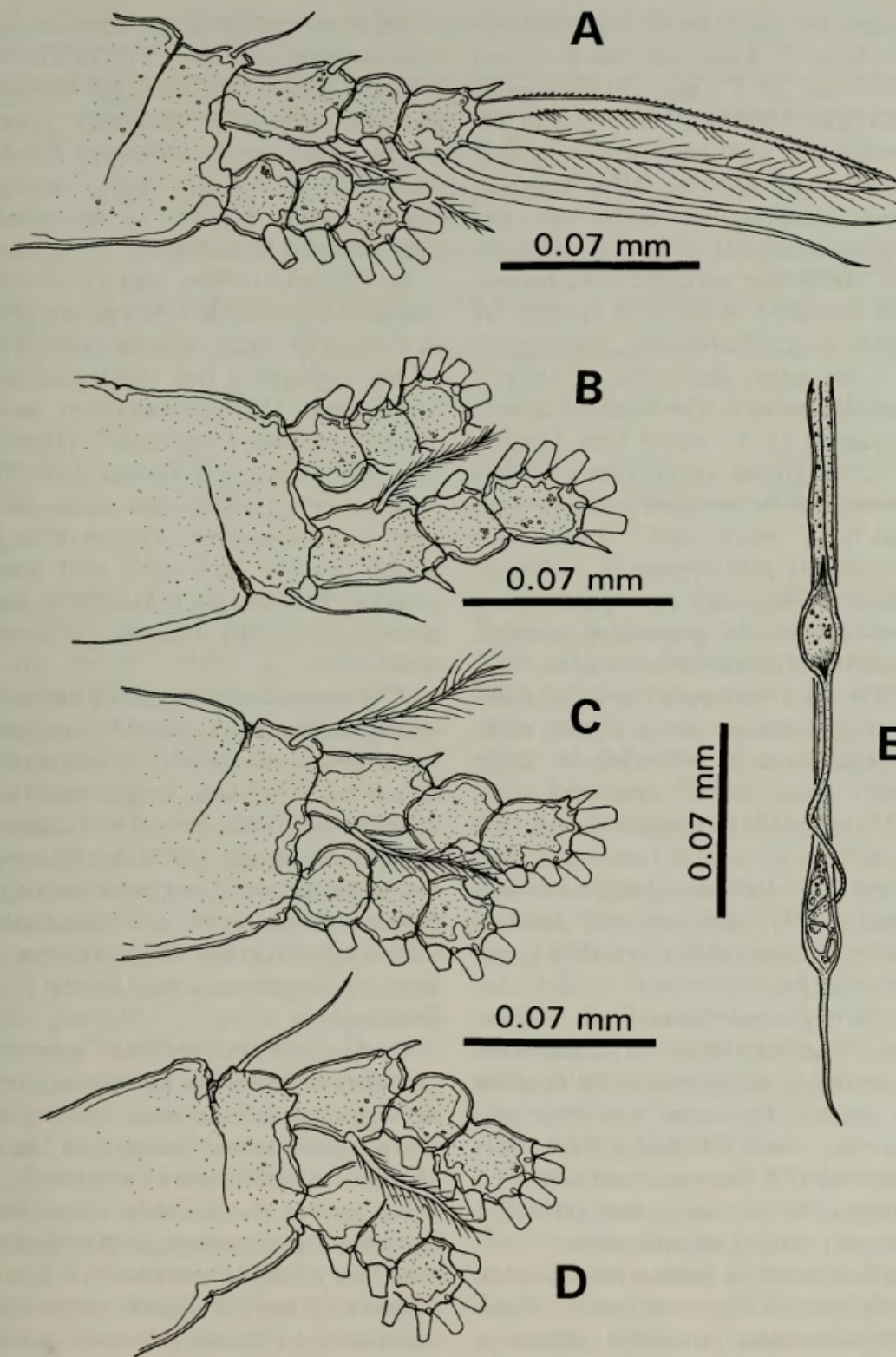


Fig. 4. *Cymbasoma californiense* n. sp., holotype female. A. right leg 1, posterior. B. left leg 2, posterior. C. right leg 3, posterior. D. right leg 4, posterior. E. ovigerous spines, detail of distal portion.

body length; the figure for *C. chelemense* is 68%, while in *C. longispinosum* it is less than 65%, and in *C. morii* the reported range (Grygier 1994b) is 66–73%. In the new species the oral papilla is relatively much smaller and shows a different aspect with respect to those of *C. chelemense* and *C. morii*, but is similar to that of *C. longispinosum*. The strong cuticular protuberances on the forehead of the new species are shared only by *C. chelemense*, but are different; in the latter, the striations show a more complex pattern. The forehead is only slightly rugose in *C. morii* (see Grygier 1994b). *Cymbasoma californiense* shows anteroventral knobs (nipples), which were described for *C. morii*, and *C. chelemense* and are probably also present in *C. longispinosum*. However, in the new species these knobs are reduced, not protruding as far as those described for the other species.

The fifth leg's endopodal lobe in *Cymbasoma longispinosum* has a clearly triangular-elongated shape (Giesbrecht 1892; Sars 1921; Isaac 1975), while the same structure is completely rounded in the new species, as it is in both *C. morii* (Grygier 1994b) and *C. chelemense* (Suárez-Morales & Escamilla 1997). However, this structure is relatively smaller in *C. morii* than in the other two species.

The fifth legs inner seta in *C. californiense* is relatively short in comparison with those of the other species. It is about 28% as long as the other two setae (3.5 times shorter), while this figure is 62.5% in *C. chelemense* (1.6 times shorter), 40% (2.5 times shorter) in *C. morii*, and 66% (1.5 times shorter) in *C. longispinosum*.

The armature of the antennules is similar in the four species. The new species shows the same antennular armament pattern as described in *C. morii* and *C. chelemense*, with only slight differences in the size and position of some of the smallest setae. The largest aesthetasc on the distal segment is relatively shorter in *C. californiense* than it is in *C. chelemense* and in *C. morii*. Proportions of antennular segments are similar

in these species, with the terminal segment representing more than 50% of the total antennular length. However, the antennules in the new species are relatively longer than in the other species compared herein, representing 25.5% of the cephalothorax length versus 21–22% in the other three species considered herein.

In *C. californiense* and *C. chelemense*, the genital double somite's posterior margin is about 40% wider than the anterior margin of the succeeding free (anal) somite. From Giesbrecht's (1892) illustrations, in *C. longispinosum* the proportional value is less than half (16%) that measured for the new species; in *C. morii* the value is around 30%, and the posterior margin of the genital double somite is slender and somewhat convex. This margin is slender in the other species and clearly irregular in the new species.

The proportional length of the ovigerous spines differs among the four species. In *C. longispinosum* and *C. chelemense* the spines are only 14% longer than the body (Giesbrecht 1892; Sars 1921; Suárez-Morales & Escamilla 1997). In *C. morii* they are much longer, about twice as long as the body, whereas in the new species they are 42% longer than the body. All four species have a long common base for the two ovigerous spines.

Cymbasoma californiense shows cuticular wrinkles along the lateral margins of the fifth pedigerous and anal somites, and on the posterior lateral margins of the cephalothorax. These features are absent in the other species and could be considered as a key character to recognize this species. The total body length recorded for *C. californiense* (2.2 mm) is slightly under the range reported for *C. longispinosum* and *C. chelemense* (2.3 to 3.16 mm) (Isaac 1975, Suárez-Morales & Escamilla 1997), but is slightly over the average length of *C. morii* (2.18 mm) (Grygier 1994b).

There are several species of *Cymbasoma* with a long, slender cephalothorax: *C. morii* (Sekiguchi, 1982), *C. longispinosum*

Table 1.—Comparison of features present in females of two groups of species of *Cymbasoma* with a relatively long cephalothorax.

Species	<i>C. gigas</i>	<i>C. morii</i>	<i>C. chelemense</i>	<i>C. longispinosum</i>	<i>C. californiense</i>	<i>C. bowmani</i>	<i>C. reticulatum</i>
Lobes on fifth leg	2	2	2	2	2	1	1
Inner lob	ovate	rounded	rounded	subtriangular	rounded	—	—
Nipples	?	present	present	present	reduced	absent	absent
Ovig. spines	?	joined at base	joined at base	joined at base	joined at base	separated at base	separated at base
O.S. longer than body	?	2 times	14% longer	14% longer	43% longer	shorter	shorter
Striation on gen. som.	?	present	present	not described	present	absent	absent
Striation on anal som.	?	absent	absent	not described	present	absent	absent
Striation on forehead	?	present (light)	present (strong)	not described	present (strong)	present (light)	absent

(Bourne, 1890), *C. chelemense* (Suárez-Morales & Escamilla), 1997, *Cymbasoma gigas* (A. Scott, 1909), *C. reticulatum* (Giesbrecht, 1892), and *C. bowmani* (Suárez-Morales & Gasca), 1998. As suggested by Suárez-Morales & Gasca (1998), these *Cymbasoma* species can be divided into two groups (see Table 1). In the first group, with a bilobed fifth leg, nipple-like ventral cephalic protuberances, striated genital somite, and basally fused genital spines which are longer (1.5–2 times) than the body, *C. morii*, *C. longispinosum*, *C. chelemense*, probably *C. gigas*, and now *C. californiense*, could be included. The second group shares a single-lobed fifth leg, the absence of nipple-like ventral protuberances, and basally separated genital spines that are shorter than the body (*C. reticulatum*, *C. bowmani*).

The lack of comparative biogeographical information on monstrellids is related to several factors: the scarcity of the group in plankton collections, the unsolved taxonomy of the group, the uncertainty in recognizing the male and female of the same species from plankton samples, and the irregular putative distributional patterns throughout the group (Isaac 1975). However, it is relevant to mention the known geographical ranges of the four species

compared herein. The Mediterranean, Great Britain, Mindanao, Portugal, Black Sea, Gulf of Suez, Vietnam, and the Arabian Gulf for *C. longispinosum* (Isaac 1975); the wide distribution reported for this species could be the result of overlooking closely related species. This has been suggested by Grygier & Ohtsuka (1995) for *Monstrilla helgolandica* Claus (1863). *Cymbasoma morii* has been recorded from Japan, supposedly Vietnam, and probably India (Grygier 1994b); *C. chelemense* from the southern Gulf of Mexico (Suárez-Morales & Escamilla 1997), and *C. californiense* from Baja California. Presumably, the geographical isolation of the new species with respect to the others would favour the conception of a different taxon.

This new species of *Cymbasoma* represents the second record of the genus in the Northeastern Pacific region; the only previous record was of *C. rigidum* Thompson, 1888, near the Kodiak Island, Alaska (Threlkeld 1977). It is also the first record of the genus in the California region.

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