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THE GENUS *PARACERCEIS* HANSEN, 1905
(ISOPODA, SPHAEROMATIDAE) IN THE EASTERN TROPICAL PACIFIC,
WITH THE DESCRIPTION OF A NEW SPECIES

BY

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ABSTRACT

Paracerceis spinulosa sp. nov., is described from material collected along the Pacific coast of Mexico. This species was previously reported in literature as *Paracerceis* sp. and differs from the other two species of *Paracerceis* from the eastern Pacific (i.e., *P. sculpta* (Holmes, 1904) and *P. richardsonae* Lombardo, 1988) by the presence of a large, subconical median tubercle on the telson, a much higher uropodal exopod partly covered with spiny and rounded tubercles, and a distinct spinulation pattern on all pereopods. Newly-collected material of *P. sculpta* and *P. richardsonae* provides new environmental and distributional data. Keys to the males and females of the species of *Paracerceis* of the eastern Pacific are provided.

RÉSUMÉ

Paracerceis spinulosa sp. nov. est décrite de la côte Pacifique du Mexique. Cette espèce avait été auparavant signalée comme *Paracerceis* sp.; elle diffère des deux autres espèces de *Paracerceis* du Pacifique oriental (*P. sculpta* (Holmes, 1904) et *P. richardsonae* Lombardo, 1988) par la présence d'un fort tubercule médian subconique sur le telson, d'un exopodite uropodal beaucoup plus haut et recouvert en partie de tubercules arrondis et pointus, ainsi que par la présence de très nombreuses soies et épines sur les périopodes. De nouvelles récoltes de spécimens de *P. sculpta* et de *P. richardsonae* ont fourni de nouvelles données sur la distribution géographique de ces deux espèces et leur habitat. Des clés d'identification des mâles et des femelles des espèces de *Paracerceis* du Pacifique oriental sont proposées.

INTRODUCTION

The known marine and brackish water isopods of the tropical East Pacific are represented by 124 species. The Sphaeromatidae H. Milne Edwards, 1840

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comprise 13 species in nine genera. Six sphaeromatid species have been described since 1980, indicating that the family had previously been little studied in the area (Espinosa-Pérez & Hendrickx, 2001). There are 13 species of *Paracerceis* worldwide (Kensley & Schotte, 2001) with two species, *P. richardsonae* Lombardo, 1988 and *P. sculpta* (Holmes, 1904) recorded from the eastern tropical Pacific subregion (Magdalena Bay, west coast of Baja California, Mexico, to Punta Paita, Peru, including the Gulf of California). Brusca (1980) recorded an undescribed species of *Paracerceis* from San Esteban and San Pedro [Martir] Islands, in the central Gulf of California, Mexico. Recently collected material along the Pacific coast of Mexico has allowed the rediscovery of this species and also to obtain additional material of the other two species of *Paracerceis* known from the region.

Abbreviations used are: St., sampling station; TL, total length; NS, unsexed specimen; NM, unmeasured specimen; coll., collector; EMU-, Invertebrates Reference Collection, Mazatlán Marine Station, Universidad Nacional Autónoma de México (UNAM), followed by accession-number; CNCR-, National Collection of Crustacea, Institute of Biology, UNAM, followed by accession-number. CORTES, Cortés cruise, R/V "El Puma", UNAM.

TAXONOMY

SPHAEROMATIDAE H. Milne Edwards, 1840

Paracerceis Hansen, 1905

Paracerceis richardsonae Lombardo, 1988 (figs. 1D, 2B)

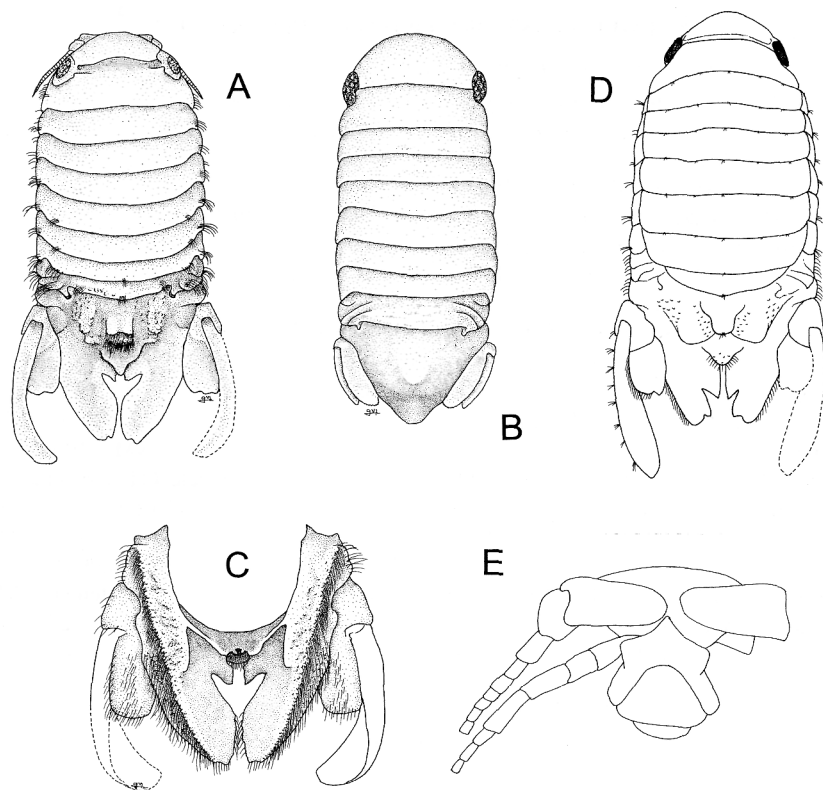
Paracerceis richardsoni Lombardo, 1988: 5-15, figs. 1-20; Espinosa-Pérez & Hendrickx, 2001: 47.

Material examined. — Sonora, Mexico: Piedras Pintas (27°56.5'N 111°05.5'W), 24 March 1997, intertidal, 3 females (TL 2.6-7.6 mm) (EMU-4694); same locality, 24 March 1997, 3 m, 4 females (TL 2.9-5.1 mm) and 2 additional specimens (NS, NM) (EMU-4693). Los Algodones Bay (27°58.6'N 111°07.7'W), 25 March 1997, 3 m, 1 male (TL 14.3 mm) and 2 females (TL 2.8 mm) (EMU-4692A); same locality, 25 March 1997, 3 m, 1 male (TL 13.7 mm), 7 females (TL 3.5-9.6 mm) and 8 additional specimens (NS, NM) (EMU-4692B); same locality, 25 March 1997, intertidal, 1 female (TL 7.1 mm) (EMU-4691). Southern Baja California, Mexico: Magdalena Bay, 23 February 1990, 1 male (TL 7.8 mm) (CNCR-10647).

Type locality. — Gulf of California, Mexico.

Previous records. — Gulf of California, Mexico (Lombardo, 1988).

Distribution. — Magdalena Bay, west coast of Baja California; Guaymas, Sonora (Gulf of California), Mexico (fig. 8). The precise type locality was not given by Lombardo (1988).



5300 Fig. 1. A-C, E, *Paracerceis spinulosa* n. sp. A, holotype male, dorsal view (EMU-4737); B, paratype female, dorsal view (CNCR-6577); C, holotype male, pleotelson, ventral view. D, *Paracerceis richardsonae* Lombardo, 1988, male, dorsal view (EMU-4692A). E, holotype male, epistome, ventral view. 5223

Habitat. — There are no habitat records for this species. The material examined here was collected from rocky beaches, among algae, from the intertidal to a depth of 3 m. Water temperature at collecting sites varied from 20.3 to 23.0°C.

Size. — Lombardo's (1988) material included the male holotype (9.5 mm TL) and the female allotype (8.2 mm TL). Material obtained during this study includes males of 7.8 to 14.3 mm and females of 2.6 to 9.6 mm; no ovigerous females were observed in the samples.

Remarks. — The spelling of the name of this species, named for Harriet Richardson, should be *richardsonae* (Art. 31.1.2. ICZN) (L. B. Holthuis, pers. comm.).

Paracerceis sculpta (Holmes, 1904) (fig. 2C)

Dynamene sculpta Holmes, 1904: 300-302, pl. 34, figs. 1-7.

Cilicæa sculpta. — Richardson, 1905: 318-319, fig. 349; Ohmart, 1964: 7.

Paracerceis sculpta — Schultz, 1969: 120, fig. 167; Menzies, 1962: 340; Miller, 1968: 1; Rezig, 1978: 175; Brusca, 1980: 226, figs. 12.5-12.6; Wallerstein, 1980: 233; Pires, 1981: 219-220; 1982: 175; Harrison & Holdich, 1982: 915; Forniz & Sconfiotti, 1983: 197; Austin, 1985: 579; Forniz & Maggiore, 1985: 780; Shuster, 1987: 71; 1989a: 331; 1989b: 1683; 1990: 390; 1991a: 91; 1991b: 365; 1992a: 75; 1992b: 232; 1995: 19; Bruce, 1990: 549; Harrison & Ellis, 1991: 943; Shuster & Michael, 1991: 1071; Rodríguez et al., 1992: 94; Shuster & Guthrie, 1999: 269; Espinosa-Pérez & Hendrickx, 2001: 47.

Sergiella angra Pires, 1980: 212-218, figs. 1-24; 1981: 219-220.

Material examined. — All material is from Pacific Mexico. Baja California: CORTES 1, St. 19, San Miguel Cape, 6 May 1982, 33-35 m, 18 males (TL 6.2-8.2 mm), 13 females (TL 5.3-6.9 mm), 5 ovigerous females (TL 6.4-7.0 mm) and 2 additional specimens (NS, NM) (EMU-4353A). CORTES 1, St. 20, San Miguel Cape, 6 May 1982, 66-69 m, 1 female (TL 6.0 mm) (EMU-4354A); same locality, 6 May 1982, 66-69 m, 2 males (TL 6.4-6.6 mm) and 1 female (TL 6.8 mm) (EMU-4354B). CORTES 2, St. 19, San Miguel Cape, 13 March 1985, 25-29 m, 3 males (TL 6.6-7.4 mm), 1 female (TL 5.8 mm) and 1 ovigerous female (TL 6.4 mm) (EMU-4353B). Southern Baja California: El Tesoro, 17 July 1996, intertidal, 4 males (TL 4.9-5.3 mm), 20 females (TL 2.0-4.3 mm) and 12 additional specimens (NS, TL 1.2-1.8 mm) (EMU-4408A); same locality, 17 July 1996, intertidal, 3 males (TL 5.2-7.5 mm), 15 females (TL 1.8-4.7 mm) and 1 additional specimen (NS, TL 1.8 mm) (EMU-4408B). Calerita, 18 July 1996, intertidal, 1 male (TL 6.9 mm) and 8 females (TL 2.2-4.9 mm) (EMU-4409). San Juan de la Costa, 19 July 1996, intertidal, 3 males (TL 5.9 mm), 4 females (TL 2.0-4.5 mm) and 6 additional specimens (NS, TL 1.6-1.7 mm) (EMU-4410A); same locality, 19 July 1996, intertidal, 3 males (TL 6.1-6.3 mm), 11 females (TL 2.0-4.7 mm) and 8 additional specimens (NS, TL 1.8-1.9 mm) (EMU-4410B). Coronado Island, 13 August 1986, 4 males (TL 5.4-6.4 mm) (CNRN-6633). San José Island, 7 August 1985, 2 males (TL 5.7-6.3 mm) and 1 female (TL 5.5 mm) (CNCR-6595). San Marcos Island, 14 August 1986, 8 males (TL 5.3-7.3 mm), 4 females (TL 4.3-5.0 mm) and 12 additional specimens (NS, NM) (CNCR-6618).

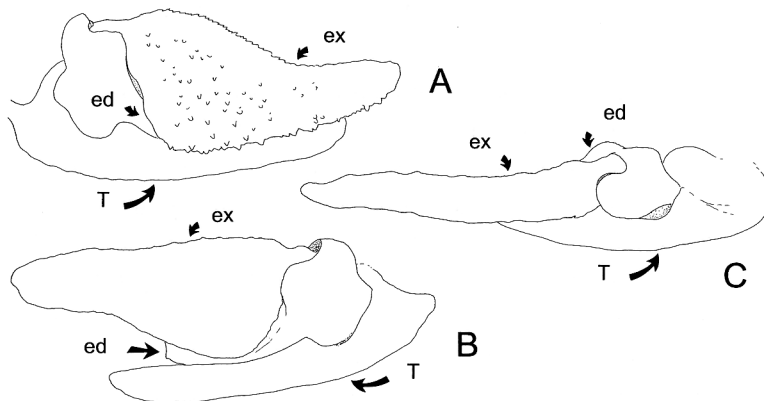


Fig. 2. Lateral view of uropodal exopod in species of *Paracerceis* from the eastern Pacific. A, *P. spinulosa* n. sp., paratype male, right exopod (CNCR-6577); B, *P. richardsonae* Lombardo, 1988, left exopod (EMU-4692A); C, *P. sculpta* (Holmes, 1904), left exopod (EMU-4700) (ed, endopod; ex, exopod; T, telson).

Espíritu Santo Island, 4 May 1987, 2 males (TL 5.6-6.4 mm) (CNCR-8124). San Marcos Island, 14 August 1986, 2 males (TL 5.3-5.4 mm) (CNCR-6627). Montserrat Island, 11 May 1987, 1 male (TL 6.3 mm) and 3 females (TL 5.1-6.0 mm) (CNCR-8275). Magdalena Bay, 26 February 1990, 1 male (TL 8.3 mm) (CNCR-10647). Montserrat Island, 10 August 1986, 1 male (TL 7.1 mm) (CNCR-6360). Salsipuedes Island, 8 May 1985, 2 males (TL 7.0-7.6 mm) (CNCR-7724). Sonora: CORTES 3, St. 47, Estero Tastiota, 6 August 1985, 28-30 m, 2 males (TL 4.8-5.9 mm) (EMU-4363). Bacochibampo, 26 March 1997, intertidal, 3 males (TL 7.2-9.0 mm) and 17 females (TL 2.8-6.9 mm) (EMU-4700). Piedras Pintas, 24 March 1997, intertidal, 3 males (TL 6.5-7.9 mm), 5 females (TL 4.6-7.3 mm) and 7 ovigerous females (TL 6.0-7.2 mm) (EMU-4699); same locality, 24 March 1997, intertidal, 2 males (TL 7.8-9.0 mm), 45 females (TL 4.8-6.9 mm) and 10 additional specimens (NS, NM) (EMU-4698A); same locality, 24 March 1997, intertidal, 1 male (TL 7.8 mm), 29 females (TL 2.5-8.5 mm) and 12 additional specimens (NS, NM) (EMU-4698B). Los Algodones Bay, 25 March 1997, 3 m, 1 ovigerous female (TL 8.4 mm) (EMU-4697). Bacochibampo, 26 March 1997, 3 m, 1 male (TL 8.1 mm) (EMU-4749). Sinaloa: Urias Lagoon, Mazatlán, 9 May 1995, 1 m, 4 males (TL 4.4-7.4 mm), 28 females (TL 2.2-5.4 mm) and 10 additional specimens (NS, NM) (EMU-4365). Estero Sirena, Mazatlán, 31 August 1994, 1 m, 2 males (TL 5.9-6.6 mm) (EMU-4364). Estero Caimán, Mazatlán, 31 August 1994, 1 m, 1 female (TL 3.2 mm) (EMU-4362A); same locality, 24 February 1995, 1 m, 1 male (TL 6.3 mm) and 3 females (TL 5.4-5.9 mm) (EMU-4362B). El Maviri Chico, Topolobampo, 23 October 1996, intertidal, 1 male (TL 5.9 mm), 34 females (TL 2.8-5.4 mm) and 28 additional specimens (NS, NM) (EMU-4696). Puente del Maviri, Topolobampo, 23 October 1996, intertidal, 21 females (TL 2.8-6.0 mm), 1 ovigerous female (TL 5.7 mm) and 39 additional specimens (NS, NM) (EMU-4695). Estero Caimán, Mazatlán, 20 April 1997, 1 m, 2 females (TL 3.5-4.4 mm) (EMU-4707). Nayarit: Sayulita, 10 April 1996, 3 m, 1 female (TL 3.4 mm) (EMU-4738). Colima: Manzanillo, El Arrecife, 6 November 1996, 3 m, 1 female (TL 2.6 mm) (EMU-4739). Michoacán: San Juan de Alima, 4 November 1996, intertidal, 2 females (TL 3.1-3.4 mm) and 1 additional specimen (NS, NM) (EMU-4740).

Type locality. — San Clemente Island, California, U.S.A.

Previous records. — East Pacific: San Clemente Island and San Diego, California, U.S.A. (Richardson, 1905; Wallerstein, 1980; Austin, 1985). San Quintin Bay, Southern Baja California (Menzies, 1962); Puerto Peñasco, Sonora (Ohmart, 1964); northern and central Gulf of California (Brusca, 1980), Mexico. Hawaii (Miller, 1968). West Pacific: Hong Kong (Bruce, 1990). Australia (Harrison & Holdich, 1982). West Atlantic: Brazil (Pires, 1980; 1981; Loyola e Silva, 1998; Loyola e Silva et al., 1999). East Atlantic: coast of Southern Spain (Rodríguez et al., 1992). Mediterranean Sea (Rezig, 1978; Forniz & Sconfiatti, 1983; Forniz & Maggiore, 1985; Rodríguez et al., 1992).

Distribution. — From San Clemente Island, California, U.S.A., south to San Juan de Alima, Michoacan, Mexico, including the whole Gulf of California, Mexico (fig. 8). Also recorded from Hawaii, Hong Kong, Australia, Brazil, and the Mediterranean Sea.

Habitat. — In the eastern Pacific *Paracerceis sculpta* has been recorded in association with the shallow water calcareous sponges *Leucetta* Haeckel, 1872 and *Leucosolenia* Bowerbank, 1861 (Richardson, 1905; Holmes, 1964; Brusca, 1980). Other habitats from which it has been collected include under intertidal

rocks and among *Sargassum* C. Agardh, 1820 and *Galaxaura* Lamouroux, 1816 in Brazil (Pires, 1981); in southern Spain from the muddy intertidal, with water temperatures from 13.0 to 26.1°C and salinity values of 34.5 to 39.0‰ (Rodríguez et al., 1992); from Venice in water with a salinity of 28.0 to 32.0‰ (C. Froggia, pers. comm.); and from Tunis Lake in water with a salinity of 34.0 to 46.0‰ (H. Missaoui, pers. comm.).

Offshore specimens were collected on sandy bottoms (96-100% median to fine sand), at depths from 25 to 69 m. Intertidal and shallow water (to 3 m) specimens were mostly collected from rocky shores, among algae; part of the material was obtained from *Rhizophora mangle* Linnaeus, 1753 prop roots in water no deeper than 1.5 m. Onshore water temperature for localities where intertidal and shallow water specimens were collected varied from 13.5 to 29.8°C. Offshore epibenthic temperature and dissolved oxygen concentrations varied from 13.5 to 29.8°C and from 3.0 to 4.0 ml O₂/l (table I).

Size. — Males measured 4.4 to 9.0 mm, females 1.2 to 8.5 mm and ovigerous females 5.7 to 8.4 mm (TL). Ovigerous females were collected from offshore localities in March and May and from the intertidal in March and October.

Remarks. — Recent records of *P. sculpta* in the eastern Atlantic and the Mediterranean Sea reinforce the idea that this species has taken advantage of transport by shipping to invade far-away localities (see Rodríguez et al., 1992). The presence of *P. sculpta* in habitats surrounding Mazatlán Harbor (Urías coastal lagoon and Mazatlán Bay rocky shores), in the Harbor of Cadiz and in coastal lagoons near major harbor facilities in the Mediterranean (e.g., Venice and Tunis Lake) support this hypothesis.

Considering that *P. sculpta* is a widely dispersed, abundant species (present records), it is surprising that there are no records available from the region between southeast Mexico (i.e., Oaxaca) and the Panama Canal or even further south. Environmental conditions similar to those found along the Pacific coast of Mexico are found along the western Central American coast and at least to southern Colombia and Ecuador, and many species of intertidal and shallow water crustaceans range from the Gulf of California to these South American countries (Hendrickx & Salgado-Barragán, 1991; Hendrickx, 1992), including isopods (Brusca & Iverson, 1985; Espinosa-Pérez & Hendrickx, 2001). Low tolerance to freshwater conditions within the Panama Canal itself (at Gatun Lake), would indeed represent a barrier to dispersal. According to Abele & Kim (1989), only a few euryhaline and freshwater species of crustaceans have been able to cross this barrier. Data related to the salinity tolerance of *P. sculpta* indicate that the species is rather stenohaline, suggesting that dispersal from the eastern Pacific through the Panama Canal may have occurred in ballast water of ships. Forniz & Maggioro (1985) reported on well-established, large reproductive populations of

TABLE I

Environmental parameters associated with *Paracerceis sculpta* (Holmes). D = depth (meters); St. = sampling station; IM = intertidal; S = sampling method; O = otter-trawl; A = Agassiz dredge; SC = SCUBA diving; M = manual

Cruise/ Locality	Coordinates	Date	D/S	Temp (°C)	O ₂ (ml/l)	Substrate
CORTES 1, St. 19	28°09'24"N 112°46'36"W	6/v/1982	33-38/O	14.2	3.5	Sand
CORTES 1, St. 20	28°07'48"N 112°45'06"W	6/v/1982	66-69/A	14.0	3.0	-
CORTES 2, St. 19	28°10'00"N 112°47'42"W	13/iii/1985	25-29/O	13.5	4.0	Sand
CORTES 3, St. 47	28°17'48"N 111°37'18"W	6/viii/1985	28-30/A	29.4	4.0	Sand
El Tesoro	24°18'00"N 110°19'00"W	17/vii/1996	IM/M	28.0	-	Algae
Calerita	24°21'00"N 110°16'00"W	18/vii/1996	IM/M	27.0	-	Algae
San Juan de la Costa	24°27'00"N 110°42'00"W	19/vii/1996	IM/M	29.8	-	Algae
Bocachibampo	27°54'18"N 110°57'36"W	26/iii/1997	IM/M	21.0	-	Algae
Piedras Pintas	27°56'30"N 111°05'30"W	24/iii/1997	IM/M	21.0	-	Algae
Los Algodones Bay	27°58'36"N 111°07'42"W	25/iii/1997	3/SC	23.0	-	Algae
Maviri Chico	25°36'30"N 109°08'54"W	23/x/1996	IM/M	25.0	-	Algae
Sayulita	20°52'18"N 105°28'00"W	10/iv/1996	3/SC	26.0	-	Algae
Arrecife	19°06'00"N 104°24'06"W	6/xi/1996	3/SC	29.0	-	Algae
San Juan de Alima	18°36'06"N 103°42'06"W	4/xi/1996	IM/M	29.0	-	Algae

P. sculpta in different localities along the Italian Peninsula (e.g., Venice, Sicily, Gulf of Taranto, Tyrrhenean Sea) and provided an illustration of the species. The reason why populations of *P. sculpta* have been reported neither on the Caribbean coast of Panama and Costa Rica, nor along the east coast of Mexico and Colombia, where intensive sampling has been done, remains unknown.

A detailed morphological study of specimens of *P. sculpta* introduced in different parts of the world, particularly in the western Pacific and the eastern Atlantic, and comparison with specimens from the eastern Pacific, would bring the careful taxonomic analysis needed in order to support unequivocally the status of introduced marine species observed with *P. sculpta* (see Poore, 1996). Among criteria cited by Chapman & Carlton (1991) on the appearance of *P. sculpta* in

areas where it was not found previously, the evidence of postintroduction range extension and the presence of apparently isolated populations seem to favour this status.

***Paracerceis spinulosa* sp. nov.** (figs. 1A-C, E, 2A, 3-7)

Paracerceis sp. — Brusca, 1980: 226, figs. 12.7-12.8.

Type material. — Holotype male (LT 8.1 mm), Piedras Pintas (27°56'30"N 111°05'05"W), Sonora, Mexico, 24 March 1997 (EMU-4737). Paratype male (TL 7.2 mm), San José Island (25°00'N 110°36'W), Southern Baja California, Mexico, 17 August 1986 (CNCR-6577). Paratype ovigerous female (LT 4.6 mm), San José Island (25°00'N 110°36'W), Southern Baja California, Mexico, 17 August 1986 (CNCR-6577).

Additional material. — San José Island (25°00'N 110°36'W), Southern Baja California, Mexico, 17 August 1986, 1 male (broken specimen) (CNCR-6577).

Description of male. — Body subrectangular, about 2.3 times as long as wide (fig. 1A). Length of holotype 8.1 mm.

Cephalon about twice as long as pereionite 1, dorsal surface smooth, with lateral tuft of long simple setae. Head almost five times wider than long. Epistome not visible in dorsal view, about as long as wide, constricted in its middle part, apex pointed (fig. 1E).

Pereionites 1-6 smooth, each with lateral tuft of long setae; posterior margin of pereionite 7 slightly upturned. Ventral margin of coxal plates (lateral view) straight or slightly curved.

Pleonites with the posterior margin upturned, and two lateral lobes on each side, each with tuft of long setae.

Telson as long as wide, with a strong, posteriorly truncate median bump, the posterior part of which is setose; this being flanked on either side with two submedian nodules, one set posterior to the other. The telson then seems to form a sinuate margin converging to a narrowly rounded apex. Telson posterior extension deeply incised medially, incision widest at middle part, arrow-shaped, funnelling distally, the resulting lateral processes of telson deeply concave, posterolateral margin with shallow notch (fig. 1A, C).

Antennule flagellum with 8-9 articles. Antenna flagellum with 11-12 articles, twice as long as antennular flagellum, extending to pereionite 2. Mandible palp articles 2 and 3 with 9 and 14 spines, respectively (fig. 3A). Left mandible incisor tooth 4-dentated, lacinia mobilis 3-dentated; setal row compose of 9 serrated setae; molar process with the surface nodular and peripherally serrated. Right mandible (fig. 3B) incisor 4-dentated, setal row with 6 serrated setae; molar process like in left mandible; a group of spinules on lateral margin of both mandibles. Maxillula lateral lobe apex (fig. 3C) with 5 serrated spines, 7 simple spines and basal group of

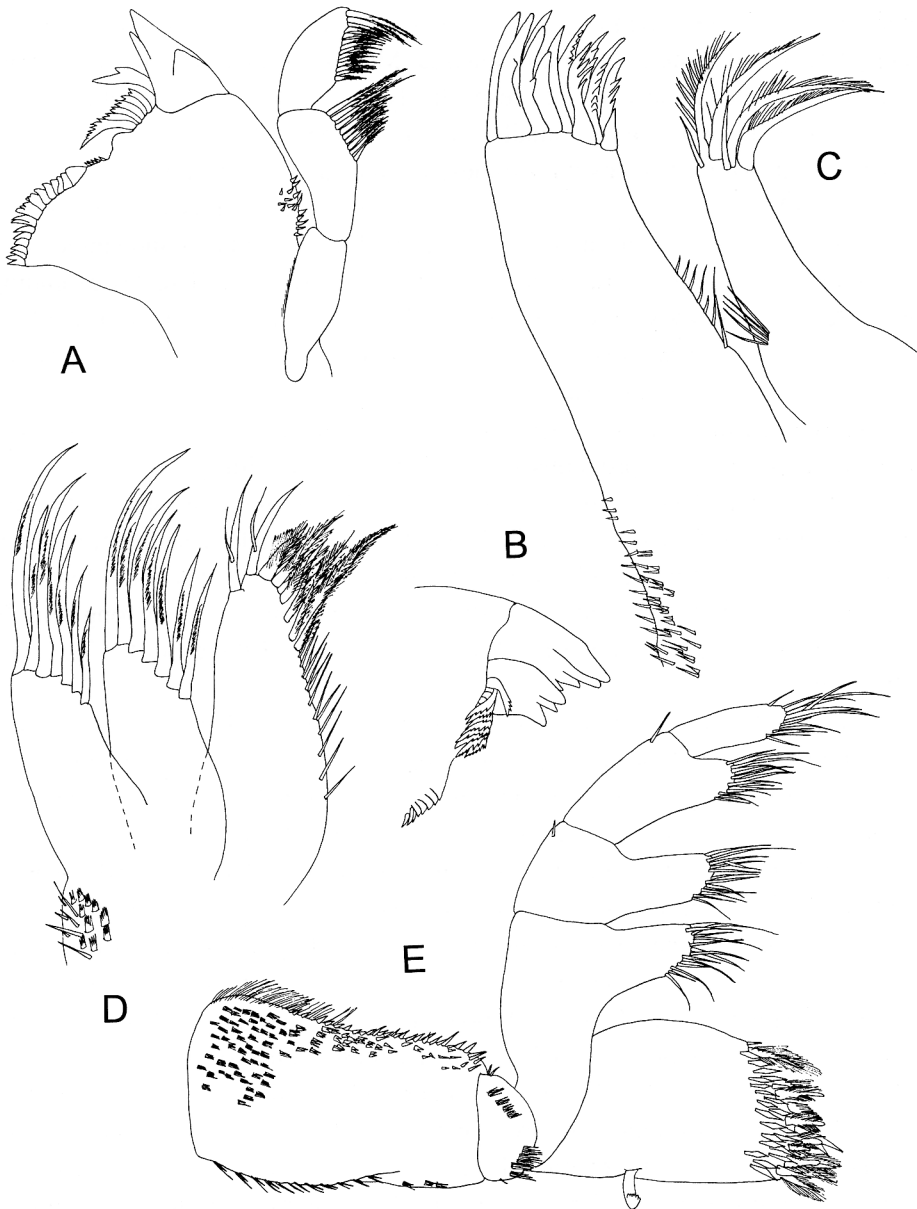


Fig. 3. *Paracerceis spinulosa* n. sp., holotype male (EMU-4737). A, left mandible; B, right mandible; C, right maxillula; D, right maxilla; E, right maxilliped.

spinules on lateral margin; medial lobe with 4 plumose spines and 2 short simple setae. Maxilla (fig. 3D) lateral lobe with 7 serrated spines; middle lobe with 7 serrated spines; medial lobe with 9 plumose spines of different size, two simple

spines each with one accessory setae, and row of 13 smaller, slender spines; a group of proximal spinules at base of maxilla. Maxilliped palp (fig. 3E) with about 14, 13, 13, 13 setae on articles 2-5, respectively; endite with a single retinaculum, 13 plumose setae, and about 17 smaller, serrated spines.

Pereiopods. All pereiopods with spines, spinules and setae on margins. Pereiopod 1 (fig. 4A) basis with rows of spinules on superior margin; ischium with rows of spinules on superior margin and a distal row of multi-dentated and single spinules on inferior margin; merus with many spinules and serrated scales extending from inferior margin and covering about 1/4 of distal and proximal surfaces of segment, 5 strong, serrated spines on inferior margin, and one curved spines and several spinules on superior distal end; carpus with similar ornamentation as in previous segment, 2 multi-dentated spinules and 3 serrated spines on inferior margin, the proximal the shortest; propodus shorter than ischium, with spinules close to the inferior margin which bears, from distal to proximal ends, three serrated scales, one conical spinule and four strong serrated spines, the proximal the shortest; dactylus more than half propodus length, with two rows of serrated scales and a few scattered spinules along inferior margin, a strong tooth and one simple, strong setae at base of unguis, two, long subterminal setae, and a row of three bifid spinules on superior margin.

Pereiopods 2-3 similar, third slightly longer than second. Pereiopod 3 (fig. 4B) basis with patch of spinules on superior margin, a batch of 5 multi-dentated distal spinules on superior margin; ischium with rows of spinules on superior margin, two bifid spinules on inferior margin, and a distal row of fine spinules on superior margin; merus with many spinules extending from inferior margin and covering about 1/5 of distal and proximal surfaces of segment, one strong curved spine on inferior margin, and one strong spine and a cluster of spinules on superior distal end; carpus with similar ornamentation as in previous segment, spinules shorter, one serrated spine and one long, bifid spine on inferior margin, and two bifid spine on superior distal end; propodus subequal to ischium, with a row of serrated scales, three serrated spines and a few simple spines and spinules on inferior margin, a subterminal cluster of spines followed with a cluster of three long, bifid spines and one plumose seta on superior distal margin; dactylus about half propodus length, with a proximal row of diminute spinules on inferior margin, followed with two rows of serrated scales and a few scattered spinules, a strong tooth and one simple, strong seta at base of unguis, two, long subterminal setae, and a row of four spinules on superior margin.

Pereiopods 5-6 similar in shape and spination to pereiopod 7; these pereiopods slightly increasing in size from 5th to 7th. Pereiopod 7 (fig. 4C) longer and slender than pereiopods 1-3; basis with rows of spinules on superior margin, a short row of simple setae at superior distal end; ischium with rows of long, fine, simple setae on

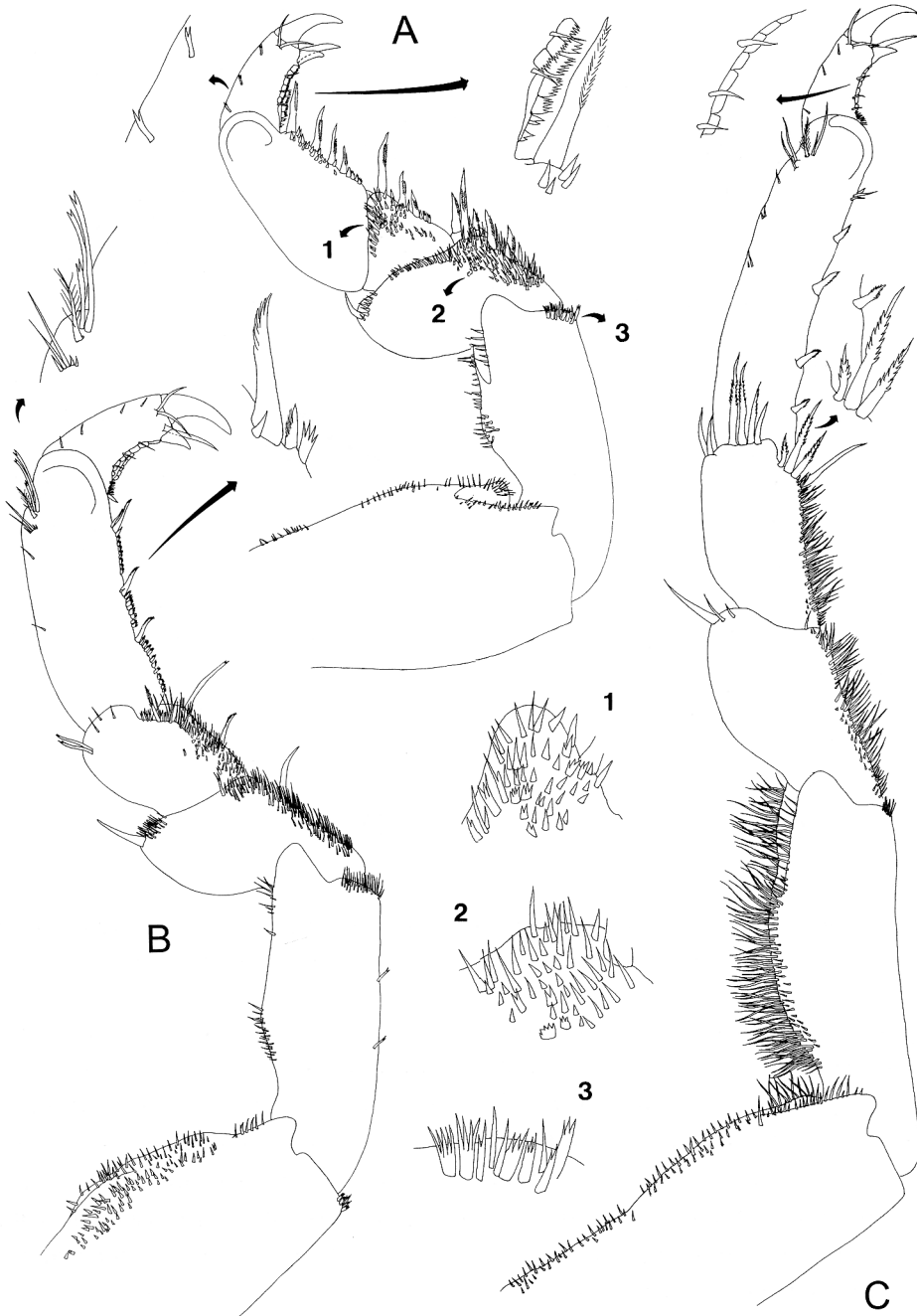


Fig. 4. *Paracerceis spinulosa* n. sp., holotype male (EMU-4737). A, right pereiopod 1; B, right pereiopod 3; C, right pereiopod 7.

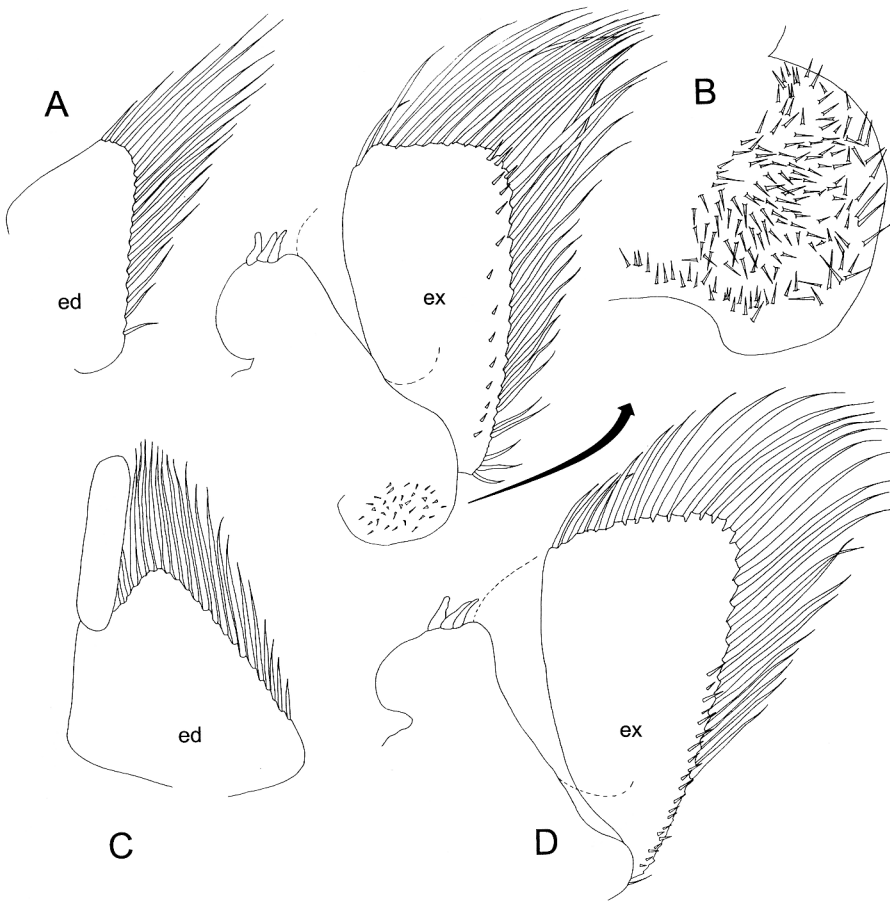


Fig. 5. *Paracerceis spinulosa* n. sp., holotype male (EMU-4737). A-B, endopod and exopod of right pleopod 1; C-D, endopod and exopod of right pleopod 2 (ed, endopod; ex, exopod).

superior margin paralleled with a row of spinules, a cluster of spinules on inferior distal end; merus with a row of spines along inferior margin paralleled with a row of spinules, one strong spine and two spinules at superior distal end; carpus with similar ornamentation as in previous segment, three serrated and one simple spines at mesiodistal end, three serrated and one simple spines on distal margin and two simple spines at superior distal end; propodus subequal to ischium, with four widely set serrated spines and a small cluster of spinules on inferior margin, few scattered spinules and a cluster of five plumose and simple setae on superior margin; dactylus less than half propodus length, similar to dactylus of pereopod 3.

Pleopods. Endopod and exopod of pleopods 1-3 (figs. 5A-D, 6A-B) with long, marginal plumose setae and a row of spinules; protopod with 2 (pleopod 3) or 3 spines. Distal margin of pleopod 1 exopod truncate; endopod triangular;

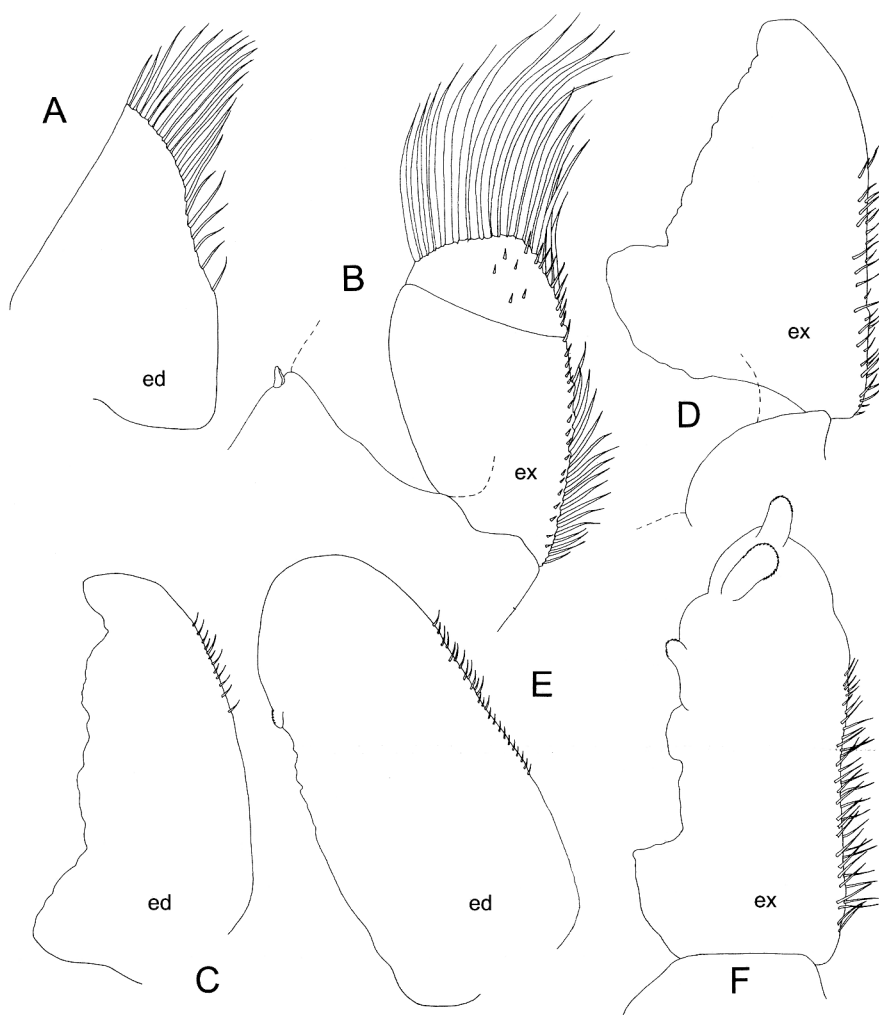


Fig. 6. *Paracerceis spinulosa* n. sp., holotype male (EMU-4737). A-B, endopod and exopod of right pleopod 3; C-D, endopod and exopod of right pleopod 4; E-F, endopod and exopod of right pleopod 5 (ed, endopod; ex, exopod).

internal part of protopod with numerous scattered, diminutive spines. Appendix masculina of pleopod 2 short, robust and of similar width throughout, tip rounded, inserted distally. Pleopods 2 and 3 as illustrated. Exopod of pleopod 3 with complete transverse suture; suture absent in exopod of pleopods 4-5. Pleopods 4-5 (fig. 6C-F) partly fringed with short spinules; pleopod 5 bearing 3 small lobes with scales close to inner distal and ventral margins of exopod, and one smaller lobe with scales on inner distal margin of endopod.

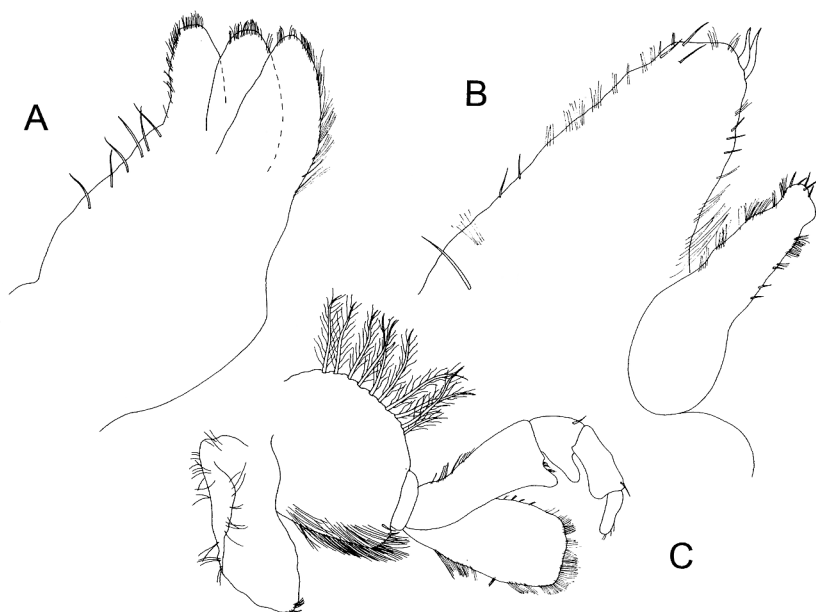


Fig. 7. *Paracerceis spinulosa* n. sp., paratype ovigerous female (CNCR-6577). A, right maxillula; B, right maxilla; C, right maxilliped.

Uropods. Exopod about twice as long as endopod, falcate, internally concave to receive endopod, distally granulated on posterior half and inner margin, this margin with some long tufts of hair; in lateral view the proximal half appears thick, much higher, coarsely granulated and the entire ventral margin bear sharp granules (fig. 2A). Endopod wide, margin setose.

Description of female. — Body ovate, about two and one third as long as wide (fig. 1B). Cephalon about as long as pereionite 1. Telson wider than long, smooth, with a low median bump; posterolateral margin slightly concave, posterior margin rounded. Pereiopods as in male. Uropods subequal, posterior margin of exopod acute, of endopod rounded. Buccal appendages (third maxilliped, maxilla, and maxillula) modified in ovigerous female, as illustrated (fig. 7A-C).

Type locality. — Piedras Pintas, Sonora, Mexico.

Previous records. — San Esteban and San Pedro Islands, Sonora, Mexico (Brusca, 1980, as *Paracerceis* sp.).

Etymology. — The species name, *spinulosa*, refers to the numerous spinules found on pereiopods. The epitheton is an adjective, agreeing in gender to the (feminine) generic name.

Habitat. — *Paracerceis spinulosa* has been taken from the chambers of calcareous sponges (*Leucetta* Haeckel, 1872 and *Leucosolenia* Bowerbank, 1861) and

among algae (Piedras Pintas) in the intertidal. Environmental data for the type material are available for a single locality (Piedras Pintas): epibenthic temperature of 20.3°C, rocky substratum covered by algae.

Distribution. — Gulf of California, from Guaymas to San Pedro Island, Sonora (east coast), and San José Island (west coast) Southern Baja California, Mexico (fig. 8).

Remarks. — *Paracerceis spinulosa* differs from the two other East Pacific species of *Paracerceis* in several characters. The telson of males of *P. spinulosa* has a large, subconical tubercle posterior to the three dorsal protuberances (bumps); this median tubercle is much weaker in *P. sculpta* and is rounded in *P. richardsonae*. The dorsal (or inner) face of the uropodal endopod is smooth in *P. spinulosa* and in *P. richardsonae*, but has two strong tubercles in *P. sculpta*. The uropodal exopod of *P. spinulosa* is high (lateral view) proximally, partly covered with spiny and rounded tubercles and with a spiny ventral margin (fig. 2A), while in the two other species the uropodal endopod is either long and narrow throughout (*P. sculpta*) (fig. 2C) or without tubercles and marginal spines or tubercles

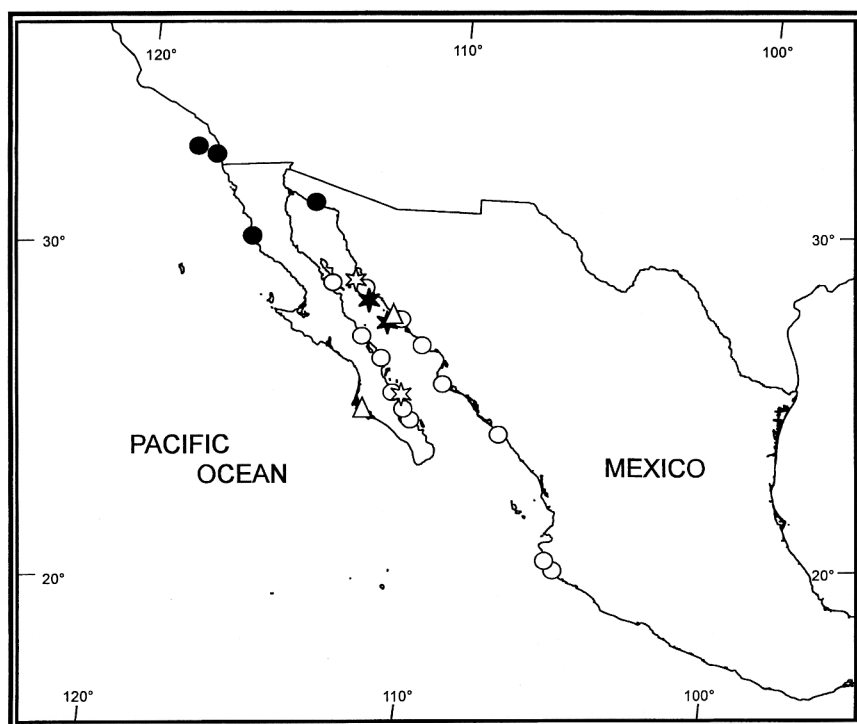


Fig. 8. Sampling sites of *Paracerceis richardsonae* Lombardo, 1988 (triangle), *P. sculpta* (Holmes, 1904) (circle), and *P. spinulosa* n. sp. (star) in the eastern tropical Pacific, including previously known localities (open symbols) and localities referred to in text (solid symbols). The type locality for *P. richardsonae* ("Gulf of California") is not indicated as such.

(*P. richardsonae*) (fig. 2B). *Paracerceis spinulosa* also shows a distinct spinulation pattern on all pereopods. As in other species of *Paracerceis*, females are more difficult to distinguish from each other; however, females of *P. spinulosa* can be separated from females of both *P. richardsonae* and *P. sculpta* by the presence of a single, moderately high, dorsal protuberance (three protuberances in the two other species).

KEY TO MALES OF *PARACERCEIS* OF THE EAST PACIFIC

1. Exopod of uropod long, slender in lateral view, of about equal height throughout; posterior part of telson with a double arrow-shaped incision *P. sculpta*
- Exopod of uropod much higher proximally in lateral view, abruptly slender distally; posterior part of telson with a single arrow-shaped incision 2
2. Ventral margin of exopod of uropod with spiny tubercles visible in lateral view; a roughly rounded protuberance posterior to the three dorsal bumps of telson *P. richardsonae*
- Ventral margin of exopod of uropod without spiny tubercles (lateral view); a strong, subconical protuberance posterior to the three dorsal bumps of telson *P. spinulosa*

KEY TO FEMALES OF *PARACERCEIS* OF THE EAST PACIFIC

1. Telson with only one medial bump dorsally *P. spinulosa*
- Telson with three dorsal bumps on telson 2
2. Medial bump long, apex triangular, overreaching lateral bumps *P. sculpta*
- Medial bump short, apex rounded, not overreaching lateral bumps *P. richardsonae*

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