

A NEW SPECIES OF *QUADRIMAERA* KRAPP-SCHICKEL & RUFFO, 2000
(AMPHIPODA: SENTICAUDATA: MAERIDAE)
FROM THE EAST COAST OF FLORIDA, USA

Especie nueva de *Quadrimaera* Krapp-Schickel & Ruffo, 2000
(Amphipoda: Senticaudata: Maeridae) de la costa este de La Florida, USA

Carlos Varela^{1a*}, Lowell Iporac^{1b} and André R. Senna²

¹Institute of Environment, Department of Biological Sciences, Florida International University, Florida, U.S.A.;
^a  <https://orcid.org/0000-0003-3293-7562>; cvare015@fiu.edu; ^b  <https://orcid.org/0000-0001-6919-3937>;
lipor001@fiu.edu. ²Universidade do Estado do Rio de Janeiro, Faculdade de Formação de Professores, Departamento
de Ciências. Rua Dr. Francisco Portela, 1470, Patronato, 24435-005. São Gonçalo, Rio de Janeiro, Brazil;  <https://orcid.org/0000-0002-6236-3849>; senna.carcinologia@gmail.com. *Corresponding author: cvare015@fiu.edu

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ABSTRACT

A new species of marine amphipod of the genus *Quadrimaera* is described from material collected from Crandon Park, Key Biscayne, Miami, Florida, USA, associated to *Penicillus* spp. about 0.5 m water depth. The differences with the closer species are also presented.

Keywords: Crustacea; Peracarida; Atlantic Ocean.

RESUMEN

Se presenta la descripción de una nueva especie de anfípodo marino del género *Quadrimaera* colectado en Crandon Park, Key Biscayne, Miami, Florida, USA. La especie se encontró asociada a *Penicillus* spp. a 0.5 metros de profundidad. Las diferencias con las especies mas cercanas son discutidas.

Palabras clave: Crustacea; Peracarida; océano Atlántico.

INTRODUCTION

The members of the genus *Quadrimaera* Krapp-Schickel & Ruffo, 2000 are a cosmopolitan group made up of 43 species (Horton et al., 2022). These individuals have a rectangular and wide gnathopod 2 in both sexes, bifid dactyli on posterior pereopods, uropod 3 rami distally truncate and spinose and article 1 of mandibular palp rounded not produced distally (Alves et al., 2018; Senna & Serejo, 2007). The species of this genus are marine and inhabit the intertidal zone and infralittoral rocky shores and coral reefs (Krapp-Schickel, 2000; Myers, 1985). To date, only two species of this genus have been recorded for Florida waters: *Quadrimaera miranda* Ruffo, Krapp and Gable, 2000 and *Q. quadrimana* (Dana, 1852).



OBJECTIVES

- To describe a new species of amphipod from the eastern coast of Florida, USA.

MATERIALS AND METHODS

Specimens were collected at Crandon Park, Key Biscayne, Miami, Florida, USA (25° 43' 4.231" N, 80° 8' 50.176" W). Crandon Park shallow coastal area is dominated by seagrasses and macroalgae. The seagrass community composed primarily of *Syringodium filiforme* (Kuetzing in Hohenacker), and *Thalassia testudinum* (Banks ex Koenig), while the macroalgal community composed of calcareous rhizophytic green algae (*Halimeda* and *Penicillus* spp.) and epiphytic red algae (*Dasya* spp. and *Laurencia* complex).

Amphipods were collected by enclosing macroalgal habitat (*Penicillus* spp. for this study) with zip-loc bags at very shallow depth (approximately 0.5 m water depth), before returning to lab for further processing. Amphipods were separated from the macroalgal habitat using tweezers and preserved in 70% ethanol solution. Each amphipod specimen was paired with its respective macroalgal habitat collected. The setal/spine classification adopted in this paper follows Garm & Watling (2013), the nomenclature of gnathopod palms is based on Poore & Lowry (1997), while the nomenclature of gnathopod 2 palm processes and excavations follows Ruffo et al. (2000). The material is deposited in the Marine Invertebrate Collection (UMML) of Rosenstiel School of Marine and Atmospheric Science (RSMAS) of University of Miami (UM).

RESULTS

Order Amphipoda Latreille, 1816

Suborder Senticaudata Lowry & Myers, 2013

Family Maeridae Krapp-Schickel, 2008

Genus *Quadrimeaera* Krapp-Schickel & Ruffo, 2000

Quadrimeaera ligiacolladoae sp. nov.

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Type Material. Holotype: Male, 5.0 mm (tl), Crandon Park, Florida, USA, Collected by L. Iporac. 0-0.5 meters deep on sand. UMML 16088. Allotype: Female, 5.0 mm (tl) UMML 16089. Paratypes: One male and two females, same data as the holotype, UMML 16090.

Diagnosis. Antenna 2, cone gland not reaching the end of article 3; peduncular article 4 subequal in length to article 5. Gnathopod 2, palm transverse, divided into two parts by a medial U-shaped excavation (a), distal part of margin (B) about 1.3 x longer than proximal part (A), which is distally truncate, B forming a right angle with the ventral margin, defined by palmar corner produced into a large acute spine, preceded by a deep U-shaped excavation (b), dactylus posterior margin with a robust spine opposite the proximal concavity of the palm of propodus, distally slightly sinuous and swollen (Ganthopod 2 characters different in *Q. ariel*, *Q. carla*, *Q. gregoryi* and *Q. pacifica* (see **Remarks**)). Epimeral plate 3 with posterior margin concave and smooth (posteroventral corner bifid in *Q. rocasensis*). Uropod 3, peduncle slightly shorter than rami; outer ramus 1-articulate (outer ramus with minute article 2 in *Q. ariadne* and *Q. pieteri*). Telson deeply cleft about 80 % of its length, lobes distally truncate (lobes distally bearing acute cusps in *Q. serrata* and *Q. massavensis* and with rounded apex in *Q. aurora*).

Diagnosis (Spanish). Antena 2, glándula cónica que no llega al final del artejo 3; pedúnculo con artejo 4 subigual en longitud al artejo 5. Gnatópodo 2, palma transversal, dividida en dos partes por una excavación medial en forma de U (a), parte distal del margen (B) alrededor de 1,3 veces más larga que la parte proximal (A), que está truncada distalmente, B forma un ángulo recto con el margen ventral, definido por la esquina palmar producida en una gran espina aguda, precedida por una excavación profunda en forma de U (b), margen posterior del dactilo con una espina robusta opuesta a la concavidad proximal de la palma del propodio, ligeramente sinuosa y ensanchada distalmente (Gnatópodo 2 con caracteres diferentes en *Q. ariel*, *Q. carla*, *Q. gregoryi* y *Q. pacifica* [ver **Remarks**]). Placa epimeral 3 con margen posterior cóncavo y liso (margen posterior bifido en *Q. rocasensis*). Urópodo 3, pedúnculo ligeramente más corto que las ramas; rama externa con un artejo (rama externa con un diminuto artejo 2 en *Q. ariadne* y *Q. pieteri*). Telson profundamente hendido alrededor del 80 % de su longitud, lóbulos truncados distalmente (lóbulos con cúspides agudas en su extremo distal en *Q. serrata* y *Q. massavensis* y con ápice redondeado en *Q. aurora*).

Description of holotype

Holotype, male, 5 mm length, from the tip of the rostrum to the insertion of telson (UMML 16088). Head without rostrum, lateral cephalic lobe truncate, eyes small, rounded (Fig. 1A).

Antenna 1 scarcely setose, peduncle 3-articulate, ratio of articles of peduncle = 1.0:1.14:0.32, article 1 with slender setae and four small stout setae on inner margin, article 2 with slender setae, and article 3 is the shortest article; primary flagellum 16-articulate, each article with one aesthetasc in its ventral side; accessory flagellum 7-articulate (Fig. 1B). Antenna 2 setose, 0.5 x shorter than antenna 1, cone gland not reaching the end of article 3; peduncular article 4 subequal in length to article 5; flagellum 9-articulate (Fig. 1B).

Left mandible, incisor with four robust spines in the cutting edge; *lacinia mobilis* with three spines; setal row with seven acute curved slender setae; molar short, cylindrical. Mandibular palp 3-articulate, ratio of articles = 1.0:0.95:1.66, article 1 without setae, article 2 with six slender setae and article 3 with six slender setae in the inner margin and three on apical margin (Fig. 1I). Right mandible, incisor with three robust spines, *lacinia mobilis* with three minutes spines on apical margin, setal row with five acute and curved slender setae, molar short, cylindrical. Mandibular palp 3-articulate, ratio of articles = 1.0:0.83:1.33, article 1 without setae, article 2 with six slender setae and article 3 with six slender setae on the inner margin and four long slender setae on apical margin (Fig. 1H).

Maxilla 1, distal margin of inner plate with one minute setae and three slender setae, inner margin with minute setae; outer plate with six bifid stout setae and minute setae along its inner margin; palp 2-articulated with a slender seta on article 1 outer margin and article 2 bears ten distal slender simple setae (Fig. 1F). Maxilla 2, inner and outer plate distally setose, outer plate with plumose setae (Fig. 1E).

Maxilliped, inner plate subrectangular with five slender setae distally, inner margin with four simple slender setae distally; outer plate suboval, inner margin with nine stout pectinate setae, apical margin with three stout pectinate setae; palp 4-articulate, article 3 with nine slender setae, article 4 with an apical nail (Fig. 1G). Upper lip subtriangular, with apical small setae (Fig. 1C). Lower lip, inner lobes apically setose; outer lobes laterally expanded, distally setose (Fig. 1D).

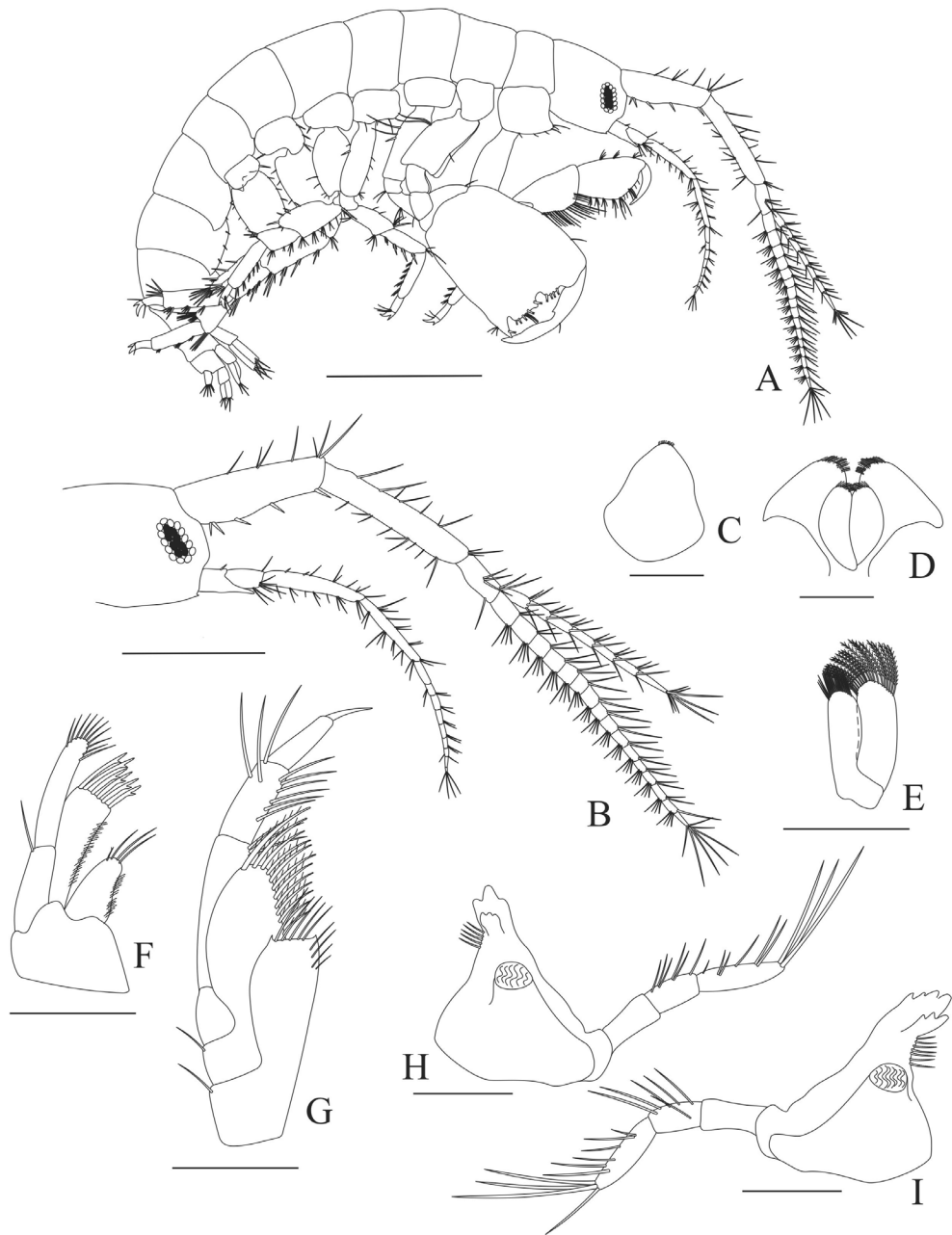


Figure 1. *Quadrimaera ligiacolladoae* sp. nov., male holotype (UMML 16088). **A)** Habitus; **B)** head with antennae 1-2; **C)** lower lip; **D)** upper lip; **E)** maxilla 2; **F)** maxilla 1; **G)** maxilliped; **H-I)** right and left mandibles. Scale bars: 1.0 mm for A; 0.5 mm for B; 0.1 mm for the remains.



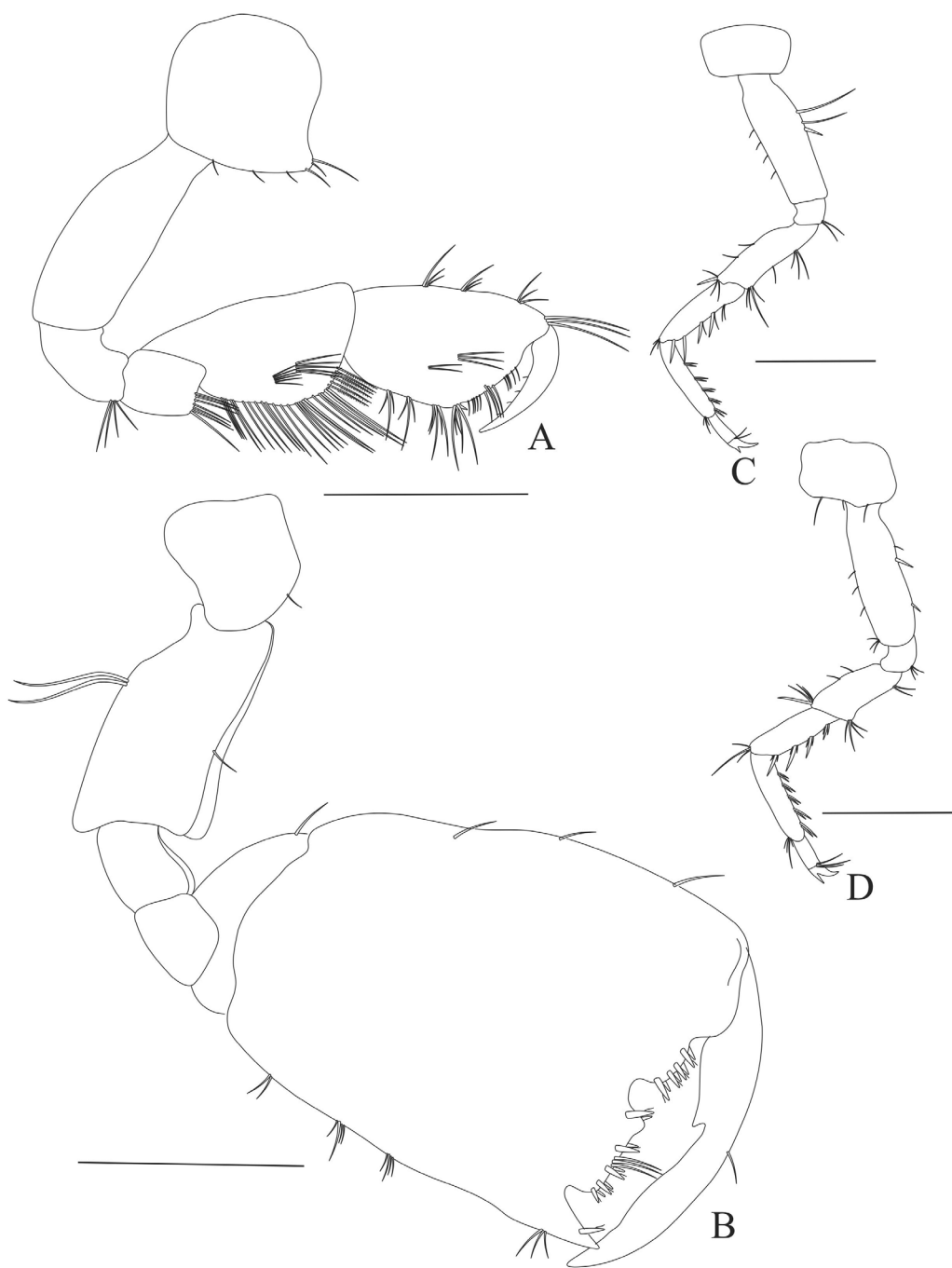


Figure 2. *Quadrimaera ligiacolladoe* sp. nov., male holotype (UMML 16088). A-B) Gnathopods 1-2; C-D) pereopods 3-4. Scale bars: 0.5 mm.

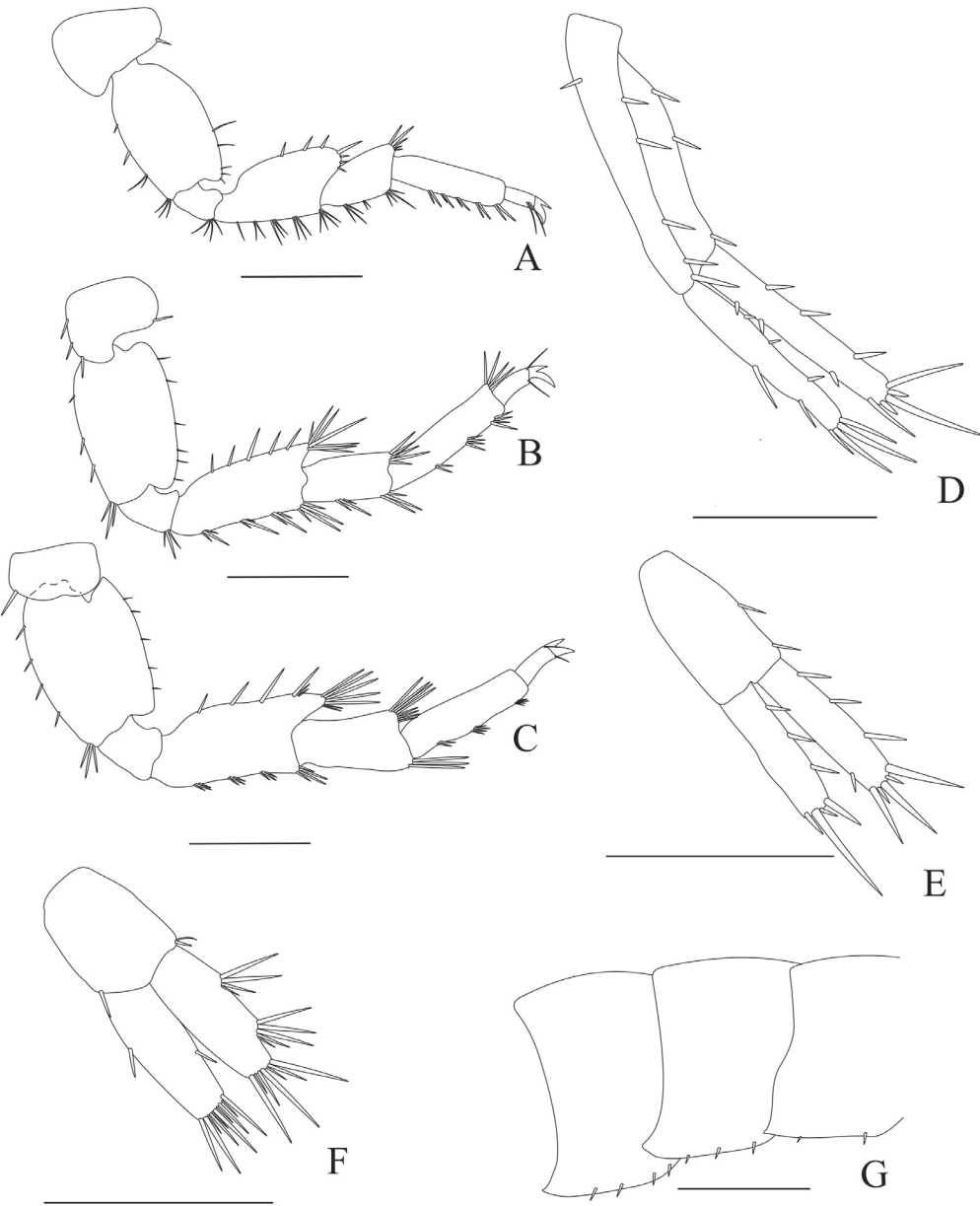


Figure 3. *Quadrimaera ligiacolladoae* sp. nov., male holotype (UMML 16088). **A-C**) Pereopods 5-7; **D-F**) uropods 1-3; **G**) epimeral plate 3. Scale bars: 0.5 mm.

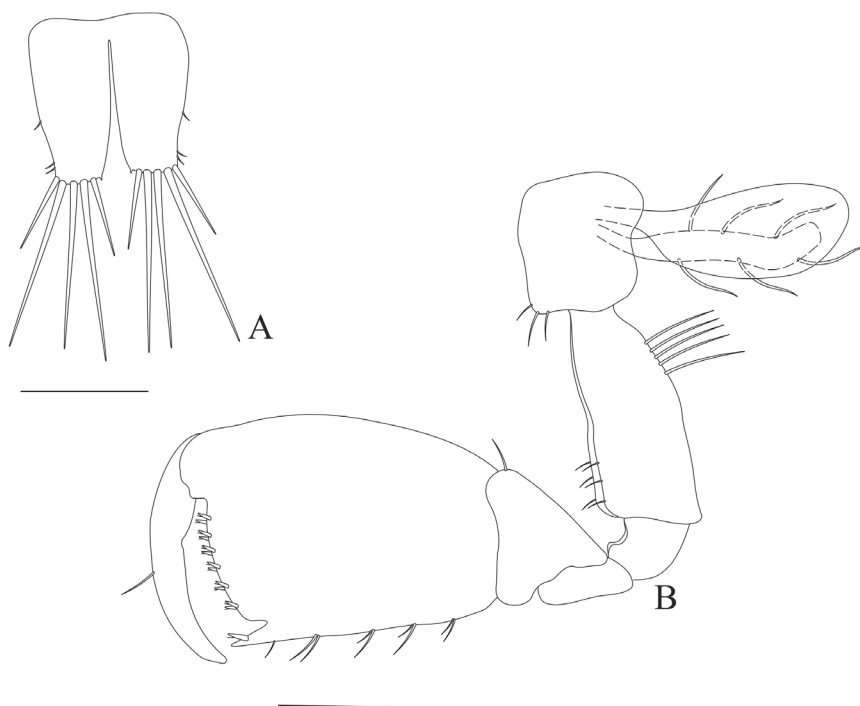


Figure 4. *Quadrimeaera ligiacolladoae* **sp. nov.**, male holotype (UMML 16088). **A)** Telson. Female allotype (UMML 16089); **B)** gnathopod 2. Scale bars: 0.5 mm.

Gnathopod 1, coxa subquadrate, anterior margin slightly concave, ventral margin with three slender setae, anteroventral corner rounded, weakly produced, bearing three slender setae; basis strong, without setae, about 1.2 x longer than ischium and merus combined; ischium, posterodistally with three slender setae; merus, posterior margin distally setose; carpus, subequal in length to basis, posterior margin densely setose and lateral surface with two small rows of setae; propodus oval, slightly shorter than carpus, about 1.7 x longer than wide, palm acute and setose, slightly shorter than posterior margin, defined by a small spine which separates it from the margin; dactylus with four small slender setae on posterior margin (Fig. 2A). Gnathopod 2 much longer and more robust than gnathopod, coxa subquadrate, ventral margin with one slender seta; basis robust, about 1.8 x longer than wide and about 1.3 x longer than ischium and merus combined, posterior margin with two long slender setae; carpus 3.4 x wider than long, triangular; propodus robust, subrectangular, distally broadened, about 1.2 x longer than the greatest width, posterior margin bearing four tufts of slender setae; palm transverse, setose, about the half length of posterior margin, divided into two parts by a medial U-shaped excavation (a), distal part of margin (B) about 1.3 x longer than proximal part (A), which is distally truncate, forming a right angle with the ventral margin, defined by palmar corner produced into a large acute spine, preceded by a deep U-shaped excavation; dactylus robust, slightly longer than palm, anterior margin with a single slender seta, posterior margin with a robust spine opposite the proximal concavity of the palm of propodus, distally slightly sinuous and swollen (Fig. 2B).

Pereopod 3 basis thin, about 0.7 x shorter than ischium, merus, and carpus combined; carpus and propodus with posterior margin setose; dactylus bearing two slender setae and a bifid nail (Fig. 2C). Pereopod 4 subequal to pereopod 3, with dactylus bearing three slender setae and a bifid nail (Fig. 2D). Pereopod 5, coxa with anteroventral corner produced, basis narrow ovato-rectangular, posterior margin with small slender setae, posteroventral corner not produced; merus, anterior margin with setal tufts, posterior margin with scarce setae; carpus with a posterodistal setal tuft; propodus, anterior margin setose; dactylus bearing two slender setae and a bifid nail (Fig. 3A). Pereopod 6 more robust and longer than pereopod 5, basis posterior margin with six small setae, posteroventral corner subquadrate; merus robust, posterior margin with five robust setae, posteroventral corner produced with a set of long robust setae; carpus subrectangular, about 0.7 x shorter than merus; propodus 0.9 x the length of merus, anterior margin with three tufts of setae, posteroventral corner with a tuft of setae; dactylus bearing two slender setae and a bifid nail (Fig. 3B). Pereopod 7 slightly longer than pereopod 6, basis with anterior and posterior margins with small setae, posteroventral corner not produced; merus robust, posterior margin with four robust setae, posteroventral corner produced, with a set of long robust setae, anterior margin with four sets of setae; carpus 0.8 x shorter than propodus, posteroventral corner with a tuft of long setae; propodus with small setae in the anterior margin; dactylus bearing one slender seta and a bifid nail (Fig. 3C).

Epimeral plate 1 with posteroventral corner produced and acute, posterior margin smooth, ventral margin with two stout setae. Epimeral plate 2 with posteroventral corner acutely produced, posterior margin smooth, ventral margin with three stout setae. Epimeral plate 3 with posterior margin concave and smooth, posteroventral corner acute, slightly produced, ventral margin with four stout setae (Fig. 3G).

Uropod 1, peduncle about 1.3 x longer than inner ramus, spur present, with three dorsal setae, five setae on lateral surface, basofacial seta present, rami apically truncate and setose, inner ramus slightly longer than outer (Fig. 3D). Uropod 2, peduncle subequal in length to inner ramus; rami dorsally and distally setose, apically truncate, inner ramus slightly longer than outer (Fig. 3E). Uropod 3, peduncle slightly shorter than rami; inner ramus subequal in length to outer ramus, bearing apical set of setae; outer ramus 1-articulate, bearing two lateral sets plus the apical set of setae; rami apically truncate (Fig. 3F).

Telson nearly as long as wide, deeply cleft about 80 % of its length, lobes distally truncate with three long setae and two small slender setae, outer margin with three minute setae (Fig. 4A).

Female. With 5 mm (tl). Differs from male in gnathopods 2 palm, which is smooth, bearing six couples of small stout setae, medial excavation (a) absent, palmar corner preceded by a narrow U-shaped excavation (b) (Fig. 4B).

Etymology. The species is dedicated to our friend and colleague Ligia Collado-Vides.

Remarks. *Quadrimeaera ligiacolladoae* **sp. nov.** is close to a group of species in *Quadrimeaera* by sharing the palm of gnathopod 2 delimited by a strong acute spine, preceded by a deep excavation, and the presence of a strong spine in the posterior margin of the gnathopod 2 dactylus. However, the new species described here is distinguishable from all of them by the characters that we have listed below (characters in *Q. ligiacolladoae* **sp. nov.** in parentheses). *Q. ariadne* (Krapp, Marti & Ruffo, 1996), from the Aegean Sea, which shows dactylus posterior margin with just a median low hump in juveniles, but a little tooth in adult specimens, is diagnosed from

the new species by the following: gnathopod 2 palm, distal part of margin (B) forming an obtuse angle with posterior margin (right angle), the spine of palmar corner is preceded by a V-shaped excavation (U-shaped); uropod 3 rami elongate (slightly longer than peduncle), outer ramus with a minute article 2 (1-articulate); telson lobes distally incised, with rounded apex (truncate). *Q. ariel* (Ruffo, Krapp & Gable, 2000), from Bermuda, is differentiated by the following: antenna 1 flagellum 12-articulate (16-articulate); antenna 2 subequal in length to antenna 1 (shorter than), cone gland reaching the end of article 3 (not reaching the end); gnathopod 2 palm, distal part of margin (B) forming an obtuse angle with posterior margin (right angle), and palmar corner produced into an acute spine, preceded by a shallow V-shaped excavation (preceded by a deep U-shaped excavation). *Q. aurora* (Krapp, Marti & Ruffo, 1996), from the Eastern Mediterranean (Israel and Crete), shows: antenna 1 flagellum 27-articulate (16-articulate); antenna 2 peduncle article 4 about 1.3 x longer than article 5 (subequal in length); mandible palp article 3 about 0.8 x shorter than article 2 (about 1.6 x longer than); gnathopod 2 palm, distal part of margin (B) forming an obtuse angle with posterior margin (right angle), palmar corner spine preceded by a deep V-shaped excavation (deep U-shaped); telson lobes distally incised, with rounded apex (truncate). *Q. carla* Krapp-Schickel & Jarret, 2000, from Queen Charlotte Islands, British Columbia, presents the following: mandible palp article 3 slightly longer than article 2 (about 1.6 x longer than); gnathopod 2 propodus about as long as the greatest width (about 1.2 x longer than the greatest width), palm, distal part of margin (B) about 2.3 x longer than the proximal part (A), which is produced into a subacute spine (B 1.3 x longer than A, which is distally truncate), forming an obtuse angle with posterior margin (right angle).

Quadrimaera gregoryi Hughes, 2015, from Western Australia, is distinguished by: gnathopod 2, palm, distal part of margin (B) serrate (smooth), forming an obtuse angle with posterior margin (right angle), palmar corner spine preceded by a not very deep V-shaped excavation (deep U-shaped), the acute spine defining the palmar corner projects from the medial surface of the propodus (from the margin of the palm); uropod 3, inner ramus slightly shorter than outer (subequal in length). *Q. massavensis* (Kossmann, 1880), redescribed by Krapp-Schickel & Ruffo (2006) with material from Suez Canal, Gulf of Suez, and Gulf of Aqaba (Red Sea), presents the following characteristics: gnathopod 2, palm, distal part of margin (B) forming an obtuse angle with posterior margin (right angle), palmar corner spine preceded by a V-shaped excavation (U-shaped); telson lobes distally incised, bearing acute cusps (truncate). *Q. pacifica* Schellenberg, 1938, in its original description, with syntypes from Gilbert Islands (Kiribati), Viti Levu Island (Fiji), and Pearl and Hermes Reef (Hawaii), is diagnosed from the new species by the following characters: gnathopod 2, palm, U-shaped medial excavation (a) quite shallow, not very evident (not quite shallow), proximal part (A) more produced than the distal part (B) (equally produced). In additional occurrences of this species, material recorded for Cuba by Ortiz (1978), as *Q. quadrimana*, was considered by Ruffo et al. (2000) as being *Q. pacifica*. However, according to the authors, this material presents the posterior margin of the dactylus of gnathopod 2 “always smooth, and sinuous and swollen only in the middle”. The authors also examined a specimen from Hawaii, determined by Schellenberg (1938) to be a syntype of *Q. pacifica*. This individual also did not have the spine on the posterior margin of the dactylus, differing from the original description of the species itself, *Q. pacifica*, but similar to the material from Cuba. *Q. pieteri* Krapp-Schickel & Ruffo, 2000, from Lesser Antilles, shows: gnathopod 2, palm medial U-shaped excavation (a) with uneven sides (excavation regular), proximal part (A) more produced than the distal part (B) (equally produced), palmar corner spine preceded by a V-shaped excavation (U-shaped), dactylus posterior margin with a proximal concavity just before the spine opposite to the medial palmar excavation (a) (without concavity before the spine); uropod 3, outer ramus with a minute article 2 (1-articulate); telson lobes distally incised, bearing acute cusps (truncate). *Q. rocasensis* Senna & Serejo, 2007, from Rocas Atoll, Brazil, can be differentiated from the new species by:

gnathopod 2 palm, proximal part (A) more produced than the distal part (B) (equally produced), there is a second U-shaped excavation (a'), small and shallow, next to the proximal deepest U-shaped excavation (a) (second U-shaped excavation a' absent); epimeral plate 3 posteroventral corner bifid (acute, with a single tip); telson, distal bearing a nail with a small apical seta (distal nail absent). *Q. serrata* (Schellenberg, 1938), also from Gilbert Island, presents epimeral plate 3 posterior margin serrate (smooth), uropod 3 rami elongate (slightly longer than), and telson lobes distally incised, bearing acute cusps (truncate).

Distribution. *Quadrimaera ligiacolladoae* **sp. nov.** is only found in the east coast of La Florida.

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