

A new sponge-inhabiting amphipod species (Crustacea, Gammaridea, Sebiidae) from the Veracruz Coral Reef System, southwestern Gulf of Mexico

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Abstract

A new species of the genus *Seba* Bate (Amphipoda: Sebiidae) is described from the Veracruz Coral Reef System, Veracruz, south-western Gulf of Mexico. The specimens were found in association with a sponge, *Ircinia fistularis*, at depths from 8 to 10 m. *Seba alvarezi* n. sp. can be distinguished from closely related species mainly by the presence of a short, two-articulated accessory flagellum, three apical setae on article 3 of the mandible palp, and by the absence of apical setae on the inner lobe of maxilla 1. The new species is compared to closely related species in the family, and an identification key to the species of *Seba* known from the Gulf of Mexico and the Caribbean Sea is given.

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Keywords: Crustacea; Amphipoda; *Seba*; New species; Coral reef; Gulf of Mexico

Introduction

Gammaridean amphipods constitute a predominantly marine group of crustaceans that are numerous and dominant in benthic communities. In coral reefs, these organisms show high biodiversity, with multiple interactions among plants and invertebrates for protection, feeding and transport (Poore et al. 2000; Oliva-Rivera 2003; Winfield and Escobar-Briones 2007). Amphipods live on live coral, coral rubble, algae, sessile invertebrates, reef-derived sediments and seagrasses in these calcareous environments (Thomas 1993), and associated to sponges, anemones, jellyfish, mollusks and echino-

derms (Bellan-Santini 1999). Approximately 20 families of amphipods commensal on sponges have been documented in coral reefs, among which the Amphitoidae, Aoridae, Colomastigidae, Leucothoidae, Lysianassidae, Maeridae and Stenothoidae are conspicuous based on species richness and distribution (Barnard and Karaman 1991; Lowry et al. 2000; LeCroy 2000, 2001, 2004, 2007; Krapp-Schickel 2008).

Studies on the biodiversity of sponge-inhabiting amphipods in the northeastern Gulf of Mexico have focused on the Florida reefs (Thomas 1993; Thomas and Klebba 2006, 2007), on those collected by the 'Hourglass Cruises' (LeCroy 1995), and on those from southeastern Cuba (Ortiz and Lalana 1996), and have not dealt with the southwestern area of the Gulf of Mexico where the Veracruz Coral Reef System National

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Park is located. Approximately 20 gammaridean amphipod species were collected during a sampling campaign in 2007 to analyze the sponge-inhabiting macrocrustaceans in Veracruz Coral Reef System National Park. Among the specimens collected, several amphipods belonging to the genus *Seba* (Sebidae) represent a new species. The latter is described and morphologically compared with related species below. In addition, a key to the species of *Seba* in the Gulf of Mexico and Caribbean Sea is presented.

Material and methods

Amphipods were collected in the Veracruz Coral Reef System National Park, which is located off Port of Veracruz, Mexico, southwestern Gulf of Mexico, and is formed by 20 reefs and divided into south and north sectors that extend to about 20 km from the shoreline. Veracruz Coral Reef System National Park is positioned between the following coordinates: 19°00.0' and 19°16.0' N, and 95°45.0' and 96°12.0' W. The field expeditions included six stations, each sampled during May, August and October 2007. The sponges were recovered manually, using SCUBA, and placed underwater in hermetically sealed plastic bags. After reaching the shoreline, 1/1 formalin/alcohol solution was added to the plastic bags; then the crustaceans were manually removed and fixed in 70% ethanol. Amphipods were transferred to glycerin for dissection and illustration in the Crustacean Laboratory. Sebids were collected from the sponge *Ircinia fistularis* (Verrill, 1907) from Blanquilla reef (19°13'32.9" N and 96°05'53" W) at 10 m depth on 22 October 2007.

The material of *Seba alvarezii* n. sp. is deposited in the Colección Nacional de Crustáceos (CNCR), Instituto de Biología, Universidad Nacional Autónoma de México (UNAM), México, D. F. The sponge was identified and deposited in the Colección Nacional Gerardo Green (CNPGG), Instituto de Ciencias del Mar y Limnología, UNAM, México, D. F. The terminology for spines/setae is based on Watling (1989) and Lowry and Stoddart (1993).

Taxonomic section

Order Amphipoda Latreille, 1816
Suborder Gammaridea Latreille, 1802
Family Sebidae Walker, 1907
Genus *Seba* Bate, 1862

Seba alvarezii n. sp.

(Figs. 1–4)

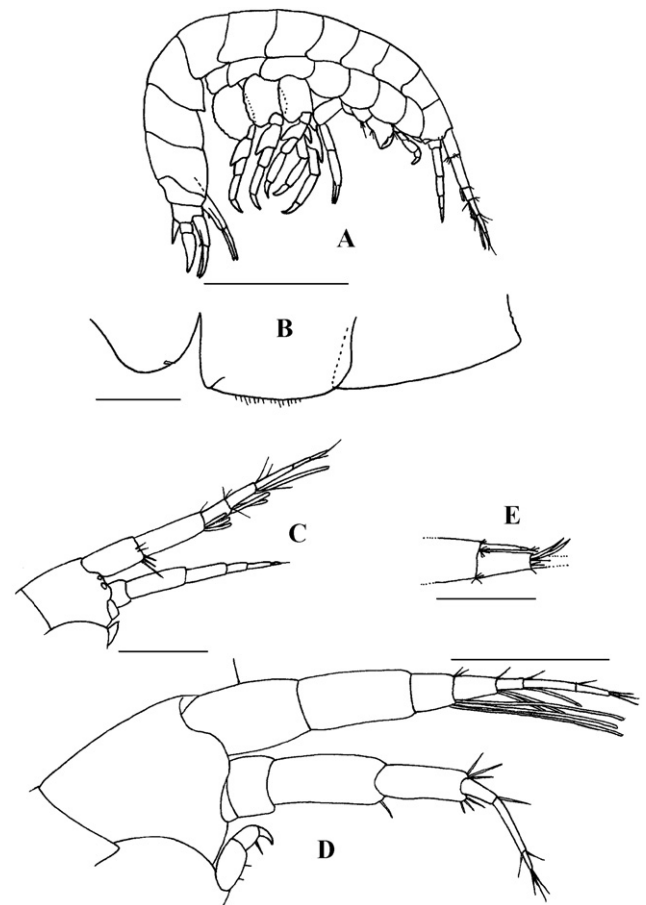


Fig. 1. *Seba alvarezii* n. sp. (A) Female paratype, habitus in lateral view. (B) Male holotype, epimera 1–3. (C) Female paratype, antennae. (D) Male holotype, antennae. (E) Male holotype, accessory flagellum. Scale bars: A, B = 1.0 mm; C, D = 0.5 mm; E = 0.2 mm.

Etymology

The new species is named in honour of Dr. Fernando Alvarez Noguera (CNCR), respected friend and renowned carcinologist.

Material

Holotype: Male, 4.6 mm (CNCR 25302); Veracruz Coral Reef System National Park, Blanquilla coral reef, Veracruz, southwestern Gulf of Mexico, coordinates 19°13'32.9" N and 96°05'53" W, depth 10 m, associated with sponge *Ircinia fistularis* (Verrill, 1907) (CNPGG0896).

Paratype: 1 female, 3.4 mm (CNCR 25303); data as for holotype.

Additional material: 8 males, 6 females (CNCR 25304); data as for holotype.

Diagnosis

Accessory flagellum short, reduced, 2-articulate. Three apical setae on article 3 of mandible palp. Inner lobe of maxilla 1 without apical setae. Lengths of carpus

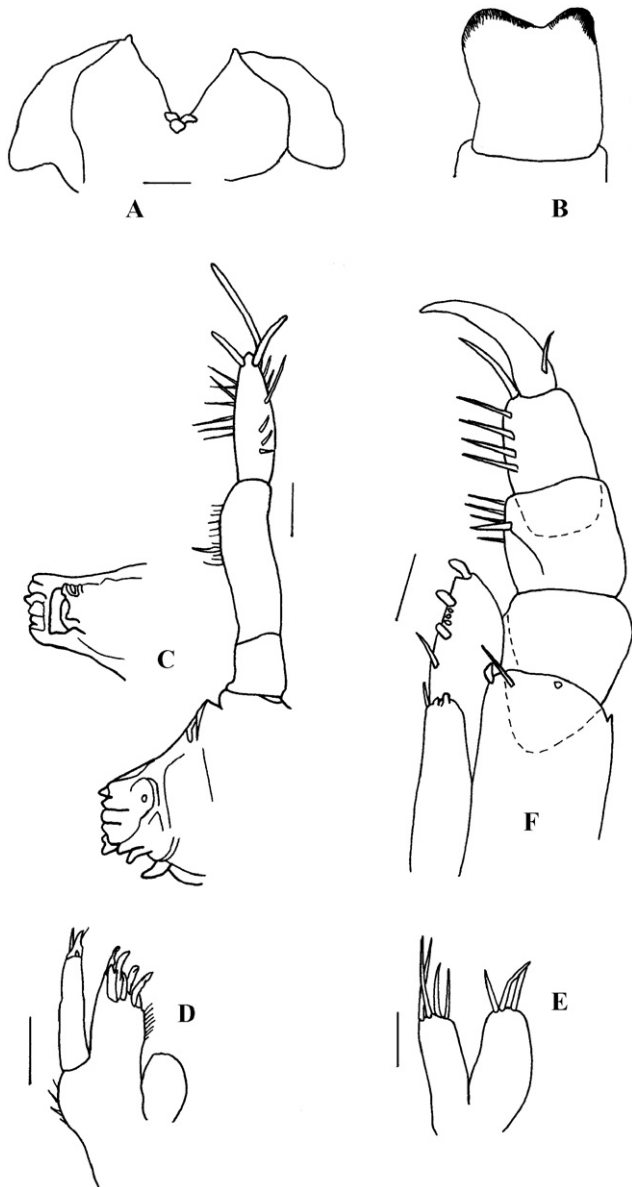


Fig. 2. *Seba alvarezi* n. sp., male holotype. (A) Lower lip. (B) Epistome and upper lip. (C) Mandible. (D) Maxilla 1. (E) Maxilla 2. (F) Maxilliped. Scale bars: 0.2 mm.

and propodus of gnathopod 2 subequal. No tooth on posteroventral corner of epimeron 3. Coxae 1 and 2 with posteroventral tooth. Telson as long as wide. Dactylus of gnathopod 1 without basal tubercle.

Description

Body (Fig. 1A). Thin, elongate, smooth. Rostrum reduced, subacute. Eyes absent in male, reduced to 2 ommatidia in female. Lateral cephalic lobule slightly prominent. Epimeron 1 (Fig. 1B) shorter than epimera 2 and 3, ventral margin rounded, smooth, 1 short,

robust seta; epimera 2 and 3 subquadrate; epimeron 2 with continuous, small setae on ventral margin, 1 groove on proximal corner; epimeron 3 with subacute posteroventral corner, distal margin slightly serrate.

Coxae (Fig. 1A). Coxae 1–4 subequal in size, with ventral margin rounded; coxa 1 with subacute anteroventral corner; coxa 3 with ventral margin slightly serrate; coxae 5–7 longer than wide, less deep than coxae 1–4; coxa 5 bilobate; coxae 6–7 with subacute distoventral margin; coxa 7 with distal margin slightly serrate.

Antennae (Fig. 1A, C, D). Antennae 1 and 2 subequal in length in male (Fig. 1D); antenna 1 longer than antenna 2 in female (Fig. 1C). Antenna 1 subequal in length to head and pereonites 1 + 2. Peduncular article 1 subequal in length, thicker than article 2, article 3 short, with distal aesthetascs well developed; article 4 shorter, thinner than article 3, with distal aesthetascs short; flagellum 3-articulate, almost 2/3 of peduncle length, with distal setae; accessory flagellum (Fig. 1E) short, reduced, 2-articulate, proximal article almost 5 × as long as distal article. Antenna 2 peduncular article 1 short, almost fused with head; article 2 almost 1/3 of article 3 length; article 3 long with 1 distal seta; article 4 thinner than article 3, subequal in length, equidistant subdistal setae; flagellum 3-articulate, distal setae.

Mouthpart bundle: Lower lip (Fig. 2A) with inner lobes reduced, obsolete, medial process reduced to 3 short, thick teeth; outer lobes slightly developed; mandible processes reduced, subacute. Epistome-labral complex (Fig. 2B) with epistome separate, slightly wider than upper lip, naked; upper lip bilobate, both lobes distally setose. Mandibles (Fig. 2C) with molar absent; left mandible with incisor, lacinia mobilis located on same level; lacinia mobilis with 5 teeth, basal reduced, with 2 separate fleshy setae; right mandible incisor with 6 teeth; lacinia mobilis anterior with respect to incisor, transverse, almost smooth; with 5 very small and closely set fleshy setae. Mandible palp 3-articulate; article 1 shorter than articles 2 and 3; article 2 slightly longer, thicker than article 3, with 12-D2 setae on posterior margin; article 3 with 7-D3 setae on posterior margin, 3-A3 lateral setae, 1-C3 submarginal seta, 2-F3 setae on anterior margin, 3-E3 long terminal setae. Maxilla 1 (Fig. 2D) inner plate suboval without distal seta; outer plate with small, equidistant marginal setae, 7 robust apical setae: 1 denticulate, 1 bifurcate, 5 simple; palp 1-articulate with 1 thin seta, 2 simple apical robust setae. Maxilla 2 (Fig. 2E) plates subequal in length, inner plate slightly more robust than outer plate, with 3 simple apical setae; outer plate with 4 slightly pectinate setae. Maxilliped (Fig. 2F) inner plate elongate, thin, with 1 simple apical seta, 2 apical protuberances; outer plate suboval, reaching 1/3 of article 2 of palp, with 1 simple robust seta medially, 3 dentiform robust setae, 3 minute marginal setae; articles 1–2 of palp subequal in length; article 1 naked;



Fig. 3. *Seba alvarezzi* n. sp. (A) Male holotype, gnathopod 1. (B) Female paratype, gnathopod 1. (C) Male holotype, gnathopod 2. (D) Male holotype, pereopod 3. (E) Male holotype, pereopod 7. Scale bars: A = 0.3 mm; B = 0.4 mm; C = 0.6 mm; D = 0.5 mm; E = 0.7 mm.

article 2 with 5 robust marginal setae, 1 submarginal robust seta; article 3 slightly thinner with 4 submarginal, 1 distal robust seta; article 4 nail-shaped, subequal in length to article 4, with 1 robust seta.

Gnathopod 1 (Fig. 3A) subchelate without facial setae; linear basis, 3 × as long as ischium, naked; ischium subequal in length to merus, naked; merus with 2 long subdistal setae; carpus lobate ventrally with 3 long

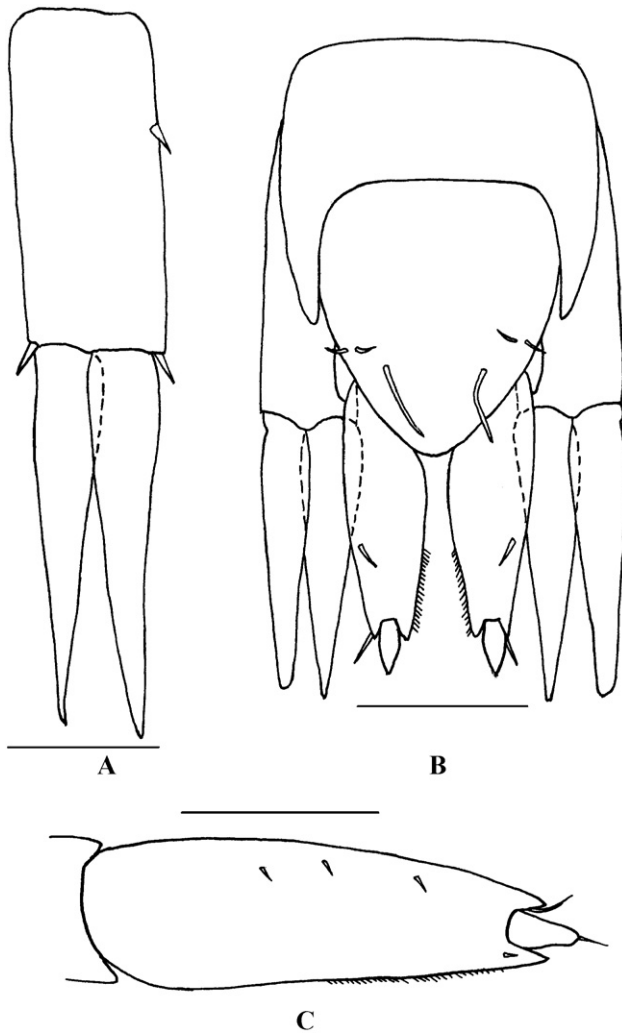


Fig. 4. *Seba alvarezi* n. sp. (A) Male holotype, uropod 1. (B) Male holotype, telson and uropods 2–3. (C) Female paratype, uropod 3. Scale bars: A, B = 0.5 mm; C = 0.7 mm.

marginal setae; propodus longer than wide, subtriangular, ventral margin with 5 continuous setae; irregular palm with 5–6 protuberances, 1 short robust seta on distal angle; dactylus elongate, subequal in length to palm with 2 small proximal protuberances, 3 short distal setae. Gnathopod 1 in female (Fig. 3B) parachelate; carpus with 2 long, thin setae on ventral margin, 2 short distal setae on dorsal margin, palm without protuberances, with 1 row of 11 spiniform submarginal setae reaching to distoventral margin.

Gnathopod 2 (Fig. 3C) elongate, chelate; basis elongate, naked, $0.2 \times$ as long as propodus; ischium naked; merus $3 \times$ as short as ischium, with 1 small distoventral seta; carpus thin, $0.7 \times$ as short as propodus, naked; propodus slender, palm smooth, slightly curved, distally narrow, with 4 distofacial setae, 1 narrow tooth on palmar corner; dactylus slender, narrow, with 1 proximal dorsal seta.

Pereopods (Fig. 3D): Pereopod 3 basis longer than wide, with 2 small marginal setae; ischium $1/4$ size of basis, naked; merus with 1 well developed anterodorsal extension almost $1/2$ length of carpus, with 1 distal seta; carpus marginally shorter than merus, distal margin with 1 robust seta, 3 plumose setae; propodus almost $3/4$ length of basis, with 3 equidistant robust setae; dactylus less than $1/2$ length of propodus. Pereopod 4 slightly longer than pereopod 3, but similar in appearance. Pereopods 5–7 (Fig. 3E) similar, basis suboval, posterior margin slightly serrate, expanded, naked, anterior margin slightly curved with 5 small equidistant robust setae, 1 distal seta; ischium with 2 setae on anterior margin; merus with well developed posterior extension, posterior margin with 4 robust setae, anterior margin with 2 pairs of setae, 1 set of 3 distal setae; carpus with 2 pairs of setae on distal margin; propodus longer than carpus, with 2 setae on anterior margin, 3 on distal margin; dactylus nail-shaped with 2 marginal setae.

Uropods (Fig. 4A, B, C): Uropod 1 (Fig. 4A) biramous, rami slightly longer than peduncle, peduncle with 1 inner marginal robust seta, 2 distal marginal robust setae; inner ramus slightly longer than outer, both naked. Uropod 2 (Fig. 4B) shorter than uropod 1, peduncle longer than rami, naked, inner ramus slightly longer than outer, both naked. Uropod 3 (Fig. 4C) uniramous, peduncle short, naked, ramus 2-articulated, first article larger, with 3 submarginal robust setae, 2 distal setae, minute setae continuous on inner margin, female with 1 submarginal medial robust seta, 1 distal seta (Fig. 4B); second article with 1 distal seta, reduced in females.

Telson (Fig. 4B) entire, laminar, subtriangular, 2 pairs of submarginal setae in medial position, 2 long distomedial setae, 1 at each side.

Table 1. World list of species in the genus *Seba*.

Species name	Authority, year of publication
<i>S. aloë</i>	Karaman, 1974
<i>S. alvarezi</i>	n. sp.
<i>S. antarctica</i>	Walker, 1904
<i>S. armata</i>	(Chevreux, 1889)
<i>S. bathybia</i>	Larsen, 2007
<i>S. chiltoni</i>	Moore, 1987
<i>S. dubia</i>	Schellenberg, 1931
<i>S. ekepuu</i>	Barnard, 1971
<i>S. gloriosae</i>	Ledoyer, 1986
<i>S. hirsuta</i>	Ledoyer, 1978
<i>S. innominata</i>	Bate, 1862
<i>S. profundus</i>	Shaw, 1989
<i>S. robusta</i>	Ortiz & Lemaitre, 1997
<i>S. saundersi</i>	Stebbing, 1875
<i>S. stoningtonensis</i>	Thurston, 1974
<i>S. subantarctica</i>	Schellenberg, 1931
<i>S. tropica</i>	McKinney, 1980
<i>S. typica</i>	(Chilton, 1884)

Table 2. Morphological comparison of *Seba alvarezi* n. sp. with the species of *Seba* considered as applicable here.

Species name	Apical setae on article 3 of mandible palp	Setae on inner lobes of maxilla 1	Palm of male gnathopod 1	Lengths of male gnathopod 2 propodus (5) ^a and dactylus (6)	Tooth in posteroventral corner of epimeron 3	Coxa 1 posteroventral tooth	Coxa 2 posteroventral tooth	Telson length relative to width	Basal tubercle on dactylus of gnathopod 1
<i>S. alvarezi</i> n. sp.	3	absent	oblique	similar	absent	present	present	similar	absent
<i>S. aloe</i>	3	1	oblique	5 < 6	absent	present	present	greater	absent
<i>S. armata</i>	2	2	transverse	5 < 6	absent	absent	absent	greater	absent
<i>S. bathybia</i>	2	1	transverse	5 < 6	absent	absent	present	greater	absent
<i>S. chiltoni</i>	3	?	oblique	5 < 6	present	absent	absent	greater	absent
<i>S. ekepuu</i>	1	absent	oblique	5 < 6	absent	absent	absent	greater	absent
<i>S. gloriosae</i>	2	1	oblique	5 < 6	absent	absent	absent	greater	absent
<i>S. hirsuta</i>	2	?	oblique	5 > 6	absent	absent	absent	greater	absent
<i>S. profundus</i>	2	1	oblique	5 < 6	absent	absent	absent	similar	absent
<i>S. robusta</i>	1	absent	oblique	5 < 6	present	absent	absent	greater	present
<i>S. saundersi</i>	?	?	transverse	5 < 6	present	absent	absent	similar	absent
<i>S. tropica</i>	1	absent	transverse	5 > 6	present	absent	absent	?	absent
<i>S. typica</i>	1	absent	transverse	Similar	present	absent	absent	?	absent

Seba antarctica, *S. stoningtonensis* and *S. subantarctica* are not considered, as they are endemic to the cold seas of the southern hemisphere and we had no access to their original descriptions. *Seba dubia* and *S. innominata* are excluded, because no material was available and the original descriptions contain insufficient data.

^aThe length of the male gnathopod 2 propodus (article 5) was measured from the proximal edge to the insertion of the dactylus.

Distribution

The new species is known only from the Veracruz Coral Reef System, associated with the sponge *Ircinia fistularis* at 10 m depth.

Remarks

The family Sebidae is distributed mainly throughout the oceans of the southern hemisphere (Barnard and Karaman 1991) from 1 to 4000 m depth (Bellan-Santini 1993), as well as in brackish water habitats and as stygofauna (Bousfield 1970; Holsinger 1986). These amphipods inhabit soft bottoms, floating wood pieces and hydrothermal vents, and are commensals of some invertebrates, e.g. sponges, vestimentiferans and molluscs (Shaw 1989). Various evolutionary hypotheses have been proposed to explain the relationships among the genera of this family (Karaman 1971; Bousfield 1979; Holman and Watling 1983; Shaw 1989). The fact that no consensus has been established is attributable to the insufficient descriptions of both sexes of some species (Larsen 2007), to the continuing addition of new species, and to the exclusion of some *Seba* species from some of the published analyses.

Shaw (1989) erected the genus *Caribseba* as distinguished from *Seba* based on the absence of an accessory flagellum on antenna 1 (flagellum present in *Seba*), absence of setae on the inner lobe of maxilla 1 (setae present in *Seba*), and on the single apical seta on mandible palp article 3 (more than one seta in *Seba*). These character states are now known to be variable in *Seba robusta* Ortiz & Lemaitre, 1997 (type locality north of Isla Grande, Colombia, Caribbean Sea), *S. tropica* McKinney, 1980 (= *Caribseba tropica* sensu Shaw 1989),

and in *S. alvarezi* n. sp. (present study), all from the Caribbean Sea and Gulf of Mexico. Thus, it is no longer justified to keep *Caribseba* separated from *Seba*.

Currently, the family Sebidae includes 20 species grouped in two subfamilies: (A) Sebinae, which includes *Seba* with its 18 species (Table 1); and (B) Seborginae with the single genus *Seborgia*, comprising the two species *S. minima* Bousfield, 1970 and *S. relicta* Holsinger, 1980.

A morphological comparison of most of the *Seba* species is presented in Table 2. *Seba alvarezi* n. sp. is identified mainly by the following characteristics: Presence of three apical setae on article 3 of mandible palp, absence of apical seta from inner lobe of maxilla 1, lengths of carpus and propodus of gnathopod 2 subequal, absence of tooth from posteroventral corner of epimeron 3, coxae 1 and 2 with one posteroventral tooth, telson as long as wide, absence of basal tubercle from dactylus of gnathopod 1 (Table 2). *Seba aloe* and *S. chiltoni* are related to *S. alvarezi* n. sp. as they show three apical setae on article 3 of the mandible palp; *S. aloe* also shares the presence of a single posteroventral tooth on coxae 1 and 2. Concerning the recorded geographical distribution, *Seba tropica* and *S. robusta* are considered as endemic to the American Mediterranean (Gulf of Mexico and Caribbean Sea). *Seba alvarezi* n. sp. may be morphologically separated from these two species by the combination of presence of the accessory flagellum (absent in *S. tropica*), article 3 of mandible palp with three apical setae (one simple apical seta in *S. tropica* and *S. robusta*), presence of aesthetascs on antenna 1 in both sexes (absent in *S. robusta*), carpus and propodus of gnathopod 2 subequal in length (carpus shorter than propodus in *S. robusta*), and posteroventral corner of epimeron 3 without teeth (one tooth in *S. robusta*).

Key to species of *Seba* (subfamily Sebinae) from the American Mediterranean (Gulf of Mexico and Caribbean Sea)

1. Male gnathopod 1 with transverse palm; without accessory flagellum; without prominence on proximal part of posterior margin of dactylus; middle section of upper edge of lower lip straight in both sexes *S. tropica* McKinney
- Male gnathopod 1 with oblique palm; with accessory flagellum; with 1 or 2 prominences on proximal part of posterior margin of dactylus; middle section of upper edge of lower lip concave in both sexes 2
2. Mandible palp article 3 with 1 distal seta; carpus of gnathopod 2 longer than propodus (measured by anterior margin); posteroventral corner of epimeron 3 with 1 tooth; antenna 1 in both sexes without aesthetascs *S. robusta* Ortiz & Lemaitre
- Mandible palp article 3 with 3 strong terminal setae; gnathopod 2 with carpus and propodus subequal in length (measured by anterior margin); posteroventral corner of epimeron 3 without tooth; antenna 1 in both sexes with aesthetascs on article 3 of peduncle and on articles 1 and 2 of flagellum *S. alvarezi* n. sp.

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