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Morphological remarks in the ghost shrimp *Callichirus seilacheri* (Bott, 1955) (Decapoda, Callianassidae) [View project](#)

MORPHOLOGICAL REMARKS IN THE GHOST SHRIMP *Callichirus seilacheri* (BOTT, 1955) (DECAPODA, CALLIANASSIDAE)

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ABSTRACT

Callichirus seilacheri (Bott, 1955) is considered one of the most common ghost shrimps in the intertidal zone of sandy beaches along the eastern tropical Pacific. The present study provides new observations on the morphology of *C. seilacheri*, based on the revision of abundant material collected along the Pacific coast of Central America, including specimens from the type locality (Playa Los Blancos, El Salvador) of this species. The new features of *C. seilacheri* include: carapace with low triangular rostrum, without setae on tip; pereopod 1 highly dissimilar in adult males, but not in females and juveniles of both sexes; first pleopod sexually dimorphic; females with oval gonopores, each one of them on the ventral coxal segment of the third pereopod, and extra genital pores on the ventral coxal segment of the fifth pereopod, these latter non-functional (non connected with the ovaries). Apparently, the presence of extra gonopores in females of *C. seilacheri* is a vestigial character shared with other representatives of the same genus.

Key words: Axiidea; diagnosis; eastern Pacific; gonopores; intertidal macroinvertebrates.

OBSERVAÇÕES MORFOLÓGICAS NO CAMARÃO-FANTASMA *Callichirus seilacheri* (BOTT, 1955) (DECAPODA, CALLIANASSIDAE)

RESUMO

Callichirus seilacheri (Bott, 1955) é considerado um dos camarões-fantasmas mais comuns em zonas intertidais de praias arenosas, ao longo do Pacífico oriental tropical. O presente estudo fornece novas observações sobre a morfologia de *C. seilacheri*, com base numa revisão de material abundante coletado ao longo da costa do Pacífico, na América Central, incluindo espécimes da localidade tipo desta espécie (Playa Los Blancos, El Salvador). As características inéditas de *C. seilacheri*, incluem: carapaça com pequeno rostro triangular, e sem cerdas na extremidade; Pereópodos 1 muito desiguais em machos adultos, mas não nas fêmeas e juvenis, de ambos os sexos; Primeiro pleópodo sexualmente dimórfico; Fêmeas com gonóporos ovais, cada um na porção ventral da coxa do terceiro par de pereópodos, e poros genitais extras na porção ventral da coxa do quinto pereópodo, estes últimos não funcionais (não conectados aos ovários). Aparentemente, a presença de gonóporos extras em fêmeas de *C. seilacheri* é um caráter vestigial, compartilhado com outros representantes do mesmo gênero.

Palavras-chave: Axiidea; diagnóstico; Pacífico Leste; gonóporos; macroinvertebrados intertidais.

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INTRODUCTION

The ghost shrimp species *Callianassa seilacheri* was erected by BOTT (1955) based on two female specimens collected at El Salvador, in the Pacific coast of Central America. Subsequently, MANNING and FELDER (1986) transferred this taxon to the genus *Callichirus*, in a revision of type material of three American representatives of this genus (*Callichirus islagrande* [SCHMITT, 1935], *Callichirus major* [SAY, 1818], and *C. seilacheri*). Interestingly, these authors pointed out that holotype of *C. seilacheri* correspond actually to one male specimen (p. 441), against the first determination established by BOTT (1955) who identified it as a female (p. 49). Afterwards, SAKAI (1999) corroborated that holotype of *C. seilacheri* is a female (p. 62), thus confirming the determined in the original description of this species.

Callichirus seilacheri is considered one of the most common ghost shrimps in the intertidal zone of sandy beaches along the eastern tropical Pacific (FELDER, 2001). This species is intensely harvested by local fishermen (up to 1,200 shrimps collected per day) to be used as bait for recreational fishing (HERNÁEZ and GRANDA-RODRÍGUEZ, 2015). The captures of *C. seilacheri* have increased during the last decade as result of depletion in other traditional resources of the Pacific coast of Costa Rica (e.g., penaeid and pandalid shrimps: WEHRTMANN and NIELSEN-MUÑOZ, 2009; coastal fishes: INCOPECA, 2006). To the best of our knowledge, there is no management plan for this species in Costa Rica.

During more than half a century, *C. seilacheri* was considered the only representative of the genus *Callichirus* along the eastern Pacific (SAKAI, 1999). But HERNÁEZ *et al.* (2015), through a detailed morphological comparison between specimens from the Pacific coast of Central America and Chile demonstrated that actually the South American populations of *C. seilacheri* belong to *Callichirus garthi* (RETAMAL, 1975). Nowadays, it is considered that the distribution of *C. seilacheri* ranges from the Pacific coast of Mexico to Costa Rica (HERNÁEZ *et al.*, 2015), in sympatry with one undescribed species of *Callichirus*, which has been often mentioned in literature (FELDER *et al.*, 2003).

Part of the external morphology of *C. seilacheri* was illustrated by BOTT (1955) in his original work (p. 48, figure 7a-g). Since then, other works on *C. seilacheri* have provided illustrations of the holotype (MANNING and FELDER, 1986: p. 441, figure 3a-f), or from specimens collected in the Peruvian coast (SAKAI, 1999: p. 63, figure 12c-f; SAKAI, 2005: p. 129; SAKAI, 2011: p. 422, figure 64f-h), the Pacific coast of Mexico (AYÓN-PARENTE *et al.*, 2014: p. 7-9, figures 5a-g, 6a-d, 7a-j), and the type locality of this species (HERNÁEZ *et al.*, 2015: p. 992, 994, 995, figures 2b, 3b,d,f,h,j, 4c,d). Most of these contributions, however, are questionable because of errors during the examination of type material and taxonomic identification of analyzed specimens. For instance, MANNING and FELDER (1986) confused the sex of the holotype, arguing that this specimen is a male with the first pair of pereopods in a minor form instead of an adult female (p. 441). On the other hand, several illustrations of *C. seilacheri* presented in SAKAI's contributions, actually, belong to *C. garthi* (HERNÁEZ *et al.*, 2015), and AYÓN-PARENTE *et al.* (2014) stated to have doubts during the identification of the specimens of *Callichirus*, wherefore assigned the analyzed material to *C. cf. seilacheri* (p. 379).

In this study, we are particularly interested in examining the external morphology of *C. seilacheri*, in order to describe new morphological characters that contribute to the taxonomical knowledge of this taxon. New features include refined observations on the carapace, pereopods, male and female pleopods, and the genital apparatus in males and females. The results of this study will contribute to the knowledge of the morphology and sexual system in one of the most characteristic ghost shrimps of the American coast.

METHODS

Specimens of *Callichirus seilacheri* were extracted in July 2013 from their burrows using a hand-made yabby-pump (diameter, 77 mm; length, 100 cm) from the intertidal zone of Playa Los Blancos (13°19'38"N, 88°58'10"W), El Salvador, informed as the type locality of this species (Figure 1A-C). In addition, we collected between June and December 2012 specimens of *C. seilacheri* from the locality of Mata de Limón (09°55'12"N, 84°42'37"W), Pacific coast of Costa Rica (Figure 1D), and analyzed other specimens from the Costa Rican coast previously deposited in Museo de Zoología (MZUCR), Universidad de Costa Rica, Costa Rica (MZUCR 2156-01, 2246-02; for details see below). Size is expressed as carapace length (CL, from the postorbital margin to the posterior margin of the carapace), measured under a stereomicroscope with ocular micrometer and camera lucida or using vernier callipers (0.01 mm). The sex determination was based upon macroscopic features such as the clearly elongated carpus of the major chelipeds (males) and the presence of colored gonads in females; when these criteria did not allow a definitive sex determination, the location of the gonopores was revised, too (HERNÁEZ and WEHRTMANN, 2007). The genital apparatus in males and females was analyzed through observation of location and morphology of gonopores, including the dissection of some specimens to examine of internal morphology of reproductive system in females. Drawings were made with the aid of a camera lucida to highlight the main characters of each species. Terminology and abbreviations follow SAKAI (1999). Specimens collected during this study were deposited in the Museo de Zoología, Universidad de Costa Rica (MZUCR 3335-01, 3336-01, 3337-01, 3392-01) and in the Scientific Collection of the Research Group in Crustacean Biology (CRUSTA), Universidade Estadual Paulista (CRUSTA 120001, 120002, 120003, 120004, 120005).

Taxonomy

Family Callianassidae DANA, 1852

Genus *Callichirus* STIMPSON, 1866

Callichirus seilacheri (BOTT, 1955)

(Figures 1A, B; 2A-C; 3A-E; 4A, B; 5A-E)

Callianassa seilacheri BOTT, 1955: 47–49, figure 7A–G [type locality: Los Blancos (13°19'38"N, 88°58'10"W), El Salvador, Central America].

Callichirus seilacheri: MANNING and FELDER, 1986: 439, figure 3A–F; 1991: 775, figure 6; LEMAITRE and RAMOS, (1992): 357; HENDRICKX (1995a): 157; HENDRICKX (1995b): 390; TUDGE *et al.* (2000): 144, figures 1D, 2H; FELDER and ROBLES (2009): 330 (Table 1); HERNÁEZ *et al.* (2015): 2B, 3B, D, F, H, J; 4C, D.

Callichirus cf. seilacheri: AYÓN-PARENTE *et al.*, 2014: 7–11, figures 5A–H, 6A–D, 7A–J.

Not *Callichirus seilacheri*: SAKAI, 1999: 62–63, figure 12A,B; SAKAI, 2005: 129; SAKAI, 2011: 422, figure 64F–H.

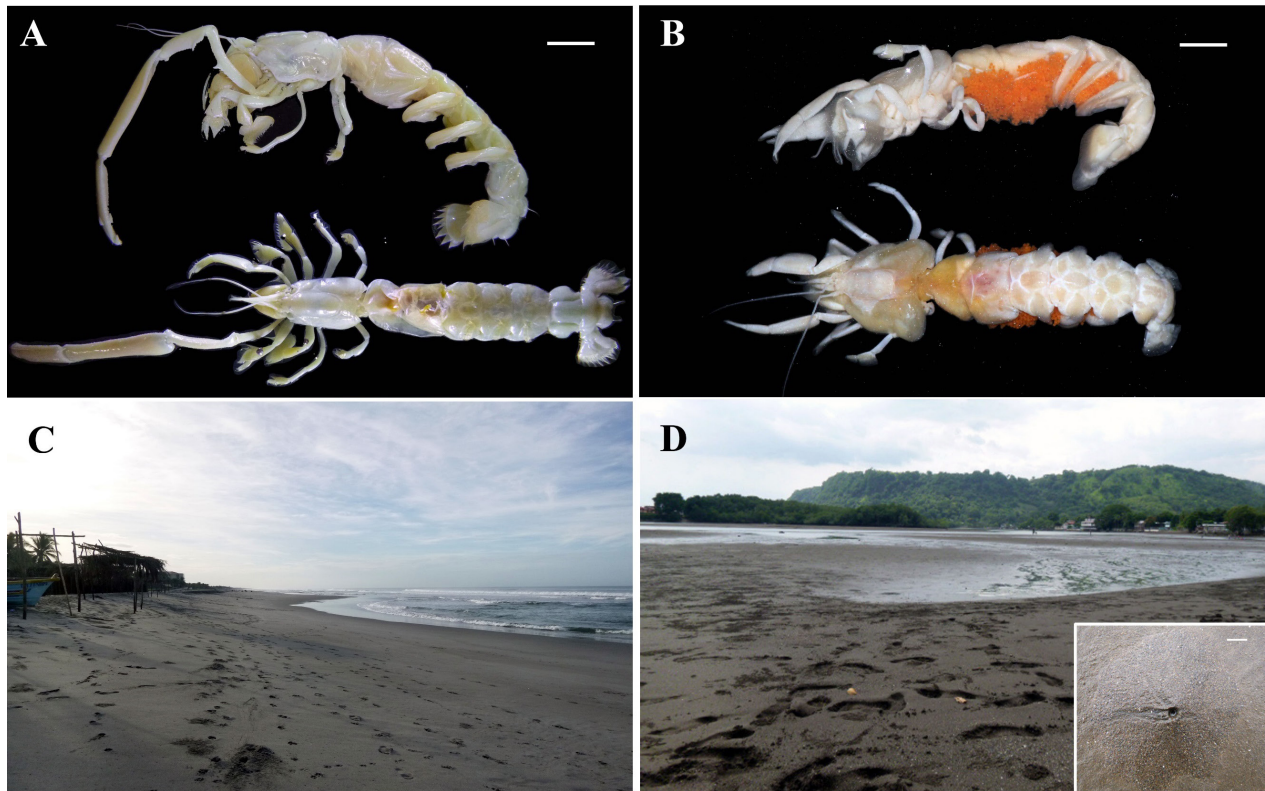


Figure 1. Lateral and dorsal view of male (A) and female (B) individuals of the ghost shrimp *Callichirus seilacheri*, scale bar = 1 cm; intertidal at Los Blancos, El Salvador, type locality of *C. seilacheri* (C) and Mata de Limon, central Pacific coast of Costa Rica (D); the inset shows a burrow opening of the ghost shrimp *C. seilacheri*, scale bar = 5 mm.

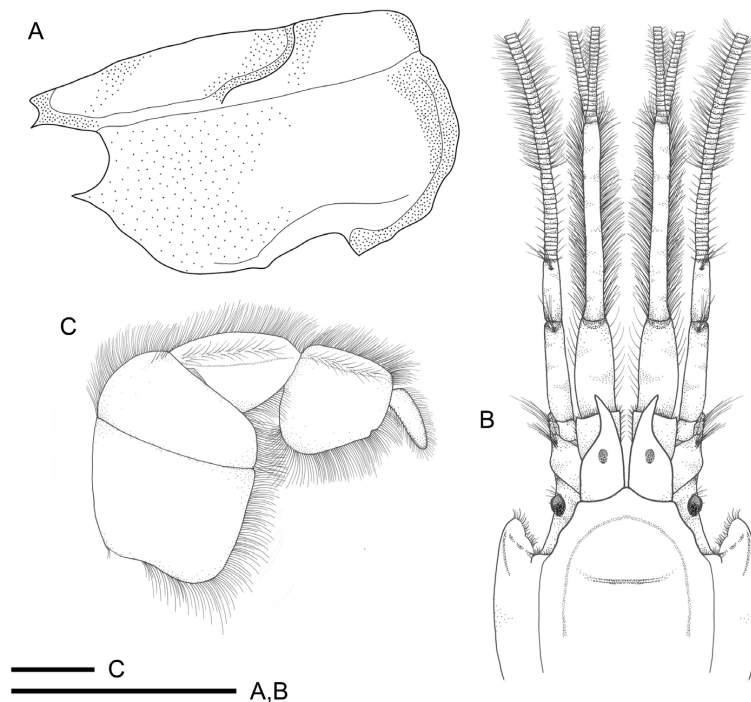


Figure 2. *Callichirus seilacheri* (BOTT, 1955), topotypical male, Los Blancos, El Salvador (MZUCR 3335-01). A, lateral view of carapace; B, anterior region of carapace, dorsal view; C, maxilliped 3, mesial view. A, B, scale bars = 1 cm; C, scale bars = 1 mm.

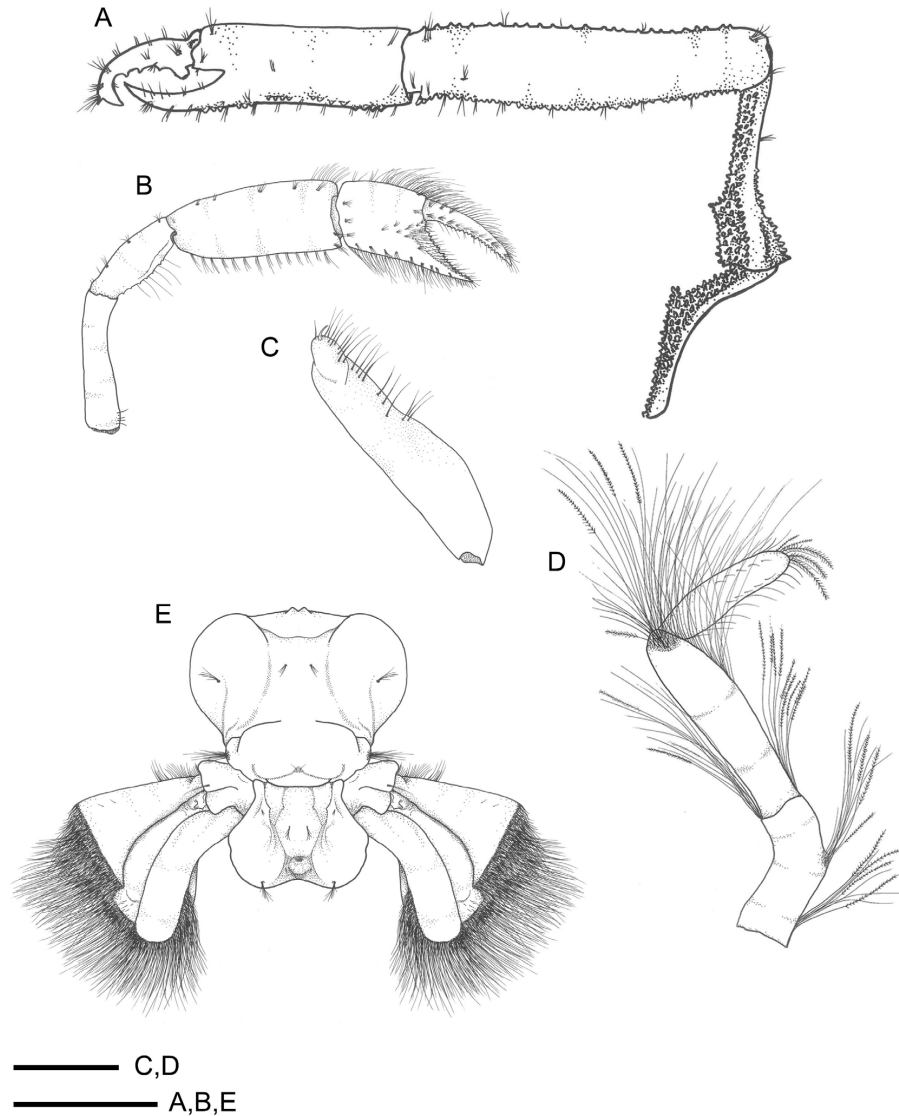


Figure 3. *Callichirus seilacheri* (BOTT, 1955), topotypic male, Los Blancos, El Salvador (MZUCR 3335-01). A, larger cheliped, lateral view; B, minor cheliped, lateral view; C, male pleopod 1, posterior view; D, female pleopod 1, posterior view; E, sixth abdominal somite and telson, dorsal view. A, B, E, scale bars = 1 cm; C, D, scale bars = 1 mm.

Material examined

Topotypic (El Salvador): MZUCR 3335-01, 2 (one male, CL: 16.3 mm; one female, CL: 24.1 mm), Los Blancos (13°19'38"N, 88°58'10"W), 22 July 2013, coll. P. Hernández and A. Gamboa-González; MZUCR 3336-01, 6 (one male, CL: 8.4 mm; five females, CL: 9.7–20.2 mm), Los Blancos (13°19'38"N, 88°58'10"W), 22 July 2013, coll. P. Hernández and A. Gamboa-González.

Other material (Costa Rica, Central Pacific coast): MZUCR 2156-01, male (CL: 15.4 mm), Puntarenas, Tivives mangrove (09°52'26"N, 84°42'19"W), 15 September 1995, coll. A.B. Williams; MZUCR 2246-02, 42 (27 males, CL: 7.0–13.8 mm; 15 females, CL: 7.0–11.6 mm), Puntarenas, Puerto de Caldera (09°55'08"N, 84°42'47"W), April 1998, coll. R. Heard, R. Vargas, O. Breedy

and E. Ruiz; MZUCR 3337-01, 31 (15 males, CL: 8.2–14.5 mm; 16 females, CL: 8.6–14.9 mm), Puntarenas, Mata de Limon (09°55'12"N, 84°42'37"W), 10 June 2012, coll. P. Hernández and A. Gamboa-González; MZUCR 3392-01, female (CL: 15.6 mm), Puntarenas, Mata de Limon (09°55'12"N, 84°42'37"W), 21 December 2012, coll. P. Hernández; CRUSTA 120001, 43 (17 males, CL: 5.9–17.8 mm; 26 females, CL: 5.2–15.6 mm), Puntarenas, Mata de Limon (09°55'12"N, 84°42'37"W), 24 October 2012, coll. P. Hernández and A. Gamboa-González; CRUSTA 120002, 80 (36 males, CL: 9.5–17.1 mm; 44 females, CL: 9.6–18.4 mm), Puntarenas, Mata de Limon (09°55'12"N, 84°42'37"W), 25 August 2012, coll. D. Gamboa-González and A. Gamboa-González; CRUSTA 120003, 26 (08 males, CL: 4.8–14.3 mm; 18 females, CL: 7.6–16.3 mm), Puntarenas,

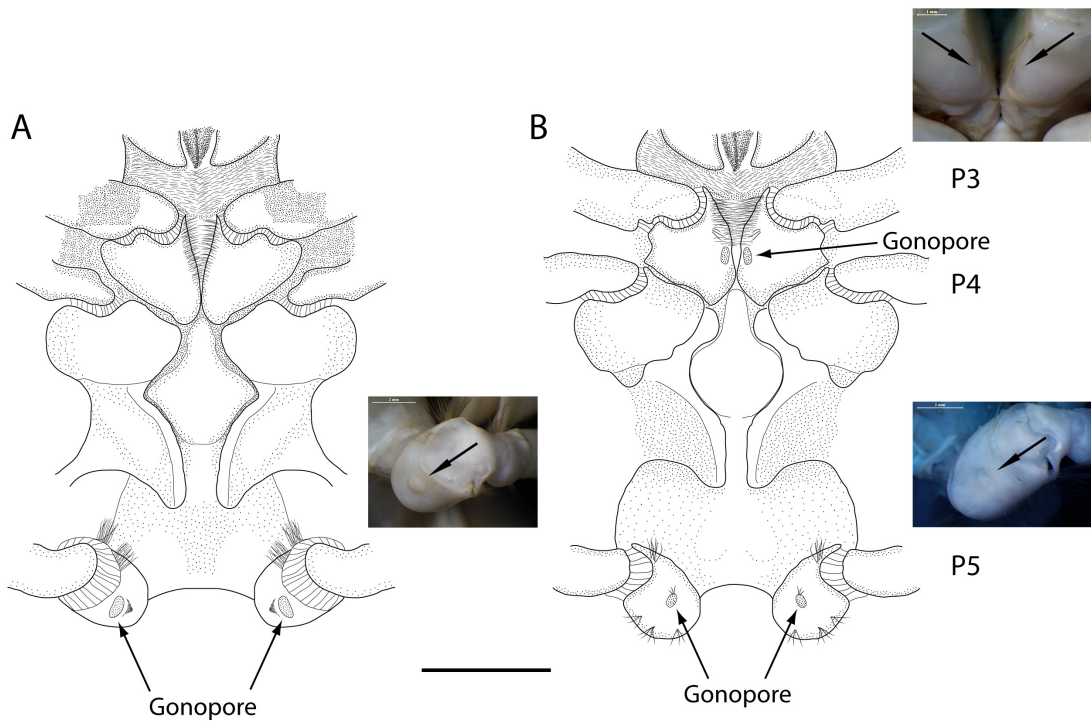


Figure 4. Schematic representation of the genital apparatus of male (A) and female (B) individuals in the ghost shrimp *Callichirus seilacheri*, scale bar = 5 mm. P3-5, indicate pereiopod 3-5, respectively. The insets show real photographs on gonopores in male and female specimen of *C. seilacheri*.

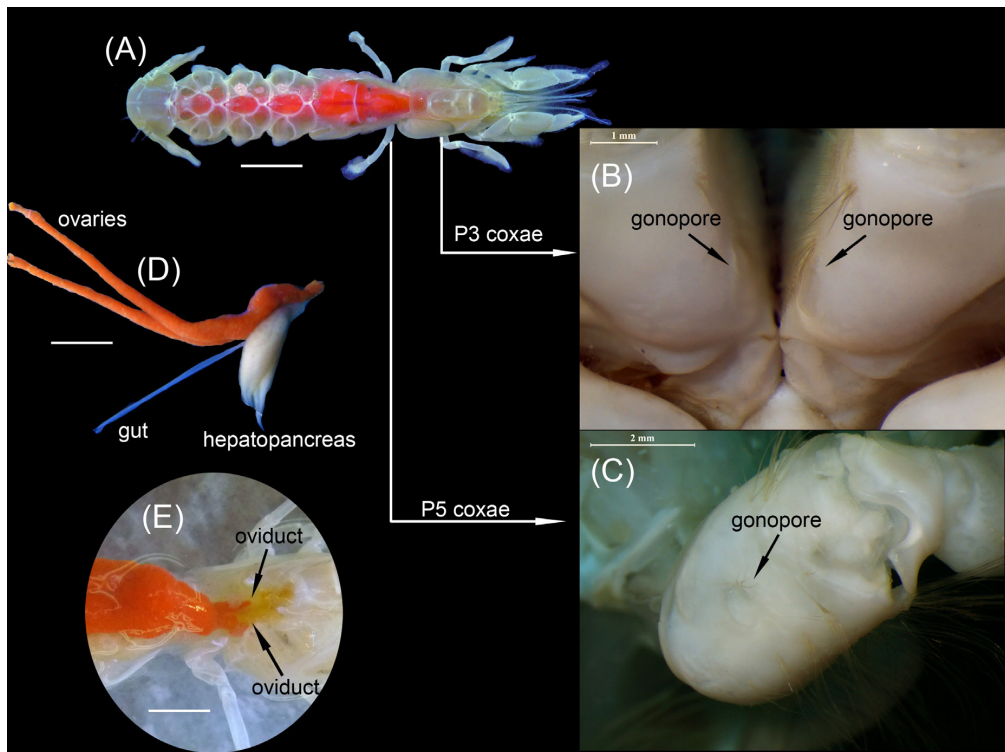


Figure 5. Adult female with developed ovaries in the ghost shrimp *Callichirus seilacheri*, in dorsal view (A); female gonopores on the coxal segment of the third pereopod, in ventral view (B); extra genital pore of female on the coxal segment of the fifth pereopod, mesial view (C); oviducts connecting the gonad with the genital pores, in dorsal view (D); internal morphology of female, in lateral view (E).

Mata de Limon (09°55'12"N, 84°42'37"W), 23 September 2012, coll. P. Hernández and A. Gamboa-González; CRUSTA 120004, 31 (15 males, CL: 8.2–14.5 mm; 16 females, CL: 8.6–14.4 mm), Puntarenas, Mata de Limon (09°55'12"N, 84°42'37"W), 17 June 2012, coll. P. Hernández; CRUSTA 120005, 30 (14 males, CL: 6.5–12.9 mm; 16 females, CL: 7.4–13.8 mm), Puntarenas, Mata de Limon (09°55'12"N, 84°42'37"W), 28 December 2011, coll. P. Hernández.

Diagnosis (modified from HERNÁEZ *et al.*, 2015; modifications are indicated in bold):

Carapace with low triangular rostrum, without setae on tip and linea thalassinica entire (Figure 2A, B). Eyestalks set apart from anterior margin of cornea, with elongated projections widely diverging laterally, **cornea small and rounded** (Figure 2B). Antennular peduncle article 2 reaching as far as antennal peduncle article 4, upper margin of antennular peduncle articles 1 and 2 non-setose (Figure 2B). Maxilliped 3 with V-shaped depression distally (Figure 2C). **Pereiopod 1 highly dissimilar in adult males but not in females and juveniles of both sexes; male larger cheliped with ischium strongly curved on dorsal margin, with hook on ventral margin, evenly spinose on flexor margin; merus with spinose rectangular proximal lobe on flexor margin; fixed finger with cutting edge smooth; dactylus with 3-5 small teeth on cutting edge** (Figure 3A). Minor cheliped merus with denticulations on ventral margin; carpus straight on flexor margin; propodus and dactylus setose (Figure 3B). **First pleopod sexually dimorphic, male first pleopod uniramous and composed of two articles, distal article with isolated setae on posterior margin, a large curved seta on tip of terminal segment** (Figure 3C); **female first pleopod uniramous and composed of three articles, distal segment flattened, shovel-shaped** (Figure 3D). **Telson bilobed, slightly wider than long** (Figure 3E). **Males with a prominent gonopores on the ventral coxal segment of the fifth pereiopod** (Figure 4A); **females with an oval gonopores on the ventral coxal segment of the third pereiopod, and extra genital pores on the ventral coxal segment of the fifth pereiopod** (Figure 4B).

Remarks on genital apparatus of *Callichirus seilacheri*

Externally, the genital apparatus of *C. seilacheri* consists of prominent gonopores on the ventral coxal segment of the fifth pereiopod in males (Figure 4A) and oval gonopores on the ventral coxal segment of the third and fifth pereiopod in females (Figure 4B, 5A-C). Our observations indicated that additional gonopore is present both in juvenile and adult females of *C. seilacheri*. The further gonopore on the coxal segment of the fifth pereiopod in females is non functional or at least we did not notice any connection between the genital pore and the ovary. The dissection of several female specimens corroborates this last observation. Both male genital pore and female are covered by a thin membrane that impedes the enter of any particle of sediment to reproductive system.

The female reproductive system involves paired ovaries, one ovary shorter than another, both visible through pleonal region (Figure 5A, D). The ovaries usually run from the posterior region

of carapace to fifth abdominal somite (Figure 5A). A pair of oviducts link ovary to gonopores located on the coxal segment of the third pereiopod (Figure 5B, D), however, it was not observed a duct connecting the gonopore of the fifth pereiopod to ovary (Figure 5C). The gut consists of a simple tube that at the level of the abdominal region is arranged between the two lobes of the gonad, while the hepatopancreas or digestive gland involves paired lobes extending from posterior region of carapace to the second abdominal somite, below gut (Figure 5E).

DISCUSSION

The original diagnosis of *Callichirus seilacheri* by BOTT (1955) includes the presence of eyestalks with elongated distal projection, bilobed telson, first pereiopod with slim chela poorly dentate, palm of second pereiopod with rounded anterior margin, and third pereiopod leaf-shaped. These features are currently insufficient to separate *C. seilacheri* from the other four American species of the genus *Callichirus* because most of these are synapomorphies. For instance, *C. garthi*, *C. islagrande* and *C. seilacheri* share eyestalk with elongated distal projections and a bilobed telson (MANNING and FELDER, 1986: p. 440-441, figure 2a,f, 3a,f; HERNÁEZ *et al.*, 2015: p. 992, figure 2a,b), while all above species, including *C. major* and *Callichirus santarosaensis* SAKAI and TURKAY, 2012, have the minor cheliped slender (MANNING and FELDER, 1986: p. 438, figure 1d; SAKAI and TURKAY, 2012: p. 747, figure 10e). Our study, for its part, improves the diagnosis of *C. seilacheri* proposed by HERNÁEZ *et al.* (2015), providing a series of new characters to distinguish to this species from other American representatives of *Callichirus*. *Callichirus seilacheri* is easily distinguished from the illustrations available in literature for *C. major* and *C. santarosaensis* by the presence of eyestalks with an elongated distal projection (MANNING and FELDER, 1986; SAKAI and TURKAY, 2012; respectively). This feature, even, may be used to separate *C. seilacheri* from the other undescribed *Callichirus*' species and reported for the Eastern Tropical Pacific (see introduction section). The similarities between *C. seilacheri* and *C. islagrande* are obvious from the illustrations available for both species (see MANNING and FELDER, 1986; HERNÁEZ *et al.*, 2015). However, *C. seilacheri* differs from *C. islagrande* because the minor cheliped merus present denticulations on ventral margin and carpus is straight on flexor margin. Main morphological characters of each American species of *Callichirus* are shown in Table 1.

In taxonomy, the diagnosis is a brief description that covers the main features to distinguish one taxon from other taxa. The lack of a good diagnosis is not a minor detail in any taxon, because it makes difficult the identification of any specimen. Albeit trivial, this crucial aspect for the identification of one taxon is many times ignored, taxonomically inappropriate or simply is absent in the original description of a species. For instance, an appropriate diagnosis is available for *C. garthi*, *C. santarosaensis* and *C. seilacheri* (SAKAI and TURKAY, 2012; HERNÁEZ *et al.*, 2015; present study). By contrast, this aspect is completely ignored in the description of *C. islagrande* and *C. major* (SCHMITT, 1935; SAY, 1818; respectively). Given the similarities

Table 1. Comparison of morphological characters among adult males of five American species of genus *Callichirus*. Where: P1, first pereiopod; Plp1, first pleopod.

Character	<i>C. garthi</i> ¹	<i>C. islagrande</i> ²	<i>C. major</i> ³	<i>C. santarosaensis</i> ⁴	<i>C. seilacheri</i> ⁵
Eyestalk	elongated distally	elongated distally	obtuse distally	obtuse distally	elongated distally
Larger cheliped (P1)					
dactylus	bifid tip	bifid tip	simple tip, never forked	?	bifid tip
Merus	meral lobe	meral hook	meral hook	?	meral hook
ischium	unarmed	armed	unarmed	?	armed
Male Plp1	non segmented	?	trisegmented	bisegmented	bisegmented
Telson	unarmed laterally	unarmed laterally	armed with a pair of lateral projections	armed with a pair of lateral projections	unarmed laterally

Source: ¹RETAMAL (1975), ²SCHMITT (1935), ³MANNING and FELDER (1986), and SAKAI (2011), ⁴SAKAI and TÜRKAY (2012), and ⁵Present study.

among American species of *Callichirus* and the presence of undescribed species of this genus occurring in the American coast (e.g., at the Pacific coast of Nicaragua, FELDER *et al.*, 2003), we believe totally necessary the publication of suitable diagnosis for *C. islagrande* and *C. major*. The former is morphologically similar to *C. seilacheri*, while the latter species, require an appropriate description because its large population along the Atlantic coast probably represent a species complex.

Another additional aspect observed in the present study is related to stability of certain morphological structures along the ontogeny of *C. seilacheri*. With the exception of the first pair of pereiopods, which changes morphologically after sexual maturity of males, the remaining structures of the body in males and females of *C. seilacheri* are well conserved along the ontogeny, in terms of shape and number of segments. For instance, the first and second pleopods are sexually dimorphic both in juveniles and adult. This characteristic also has been observed in specimens of *C. garthi* and *C. major* from the Chilean and Brazilian coast, respectively (HERNÁEZ, 2014). The identification of conserved features may be more relevant than those characters that change during the adult phase because the former allow identifying one taxon in juvenile and adult phase. Such argument is especially relevant when most of diagnoses are based exclusively in adult characters, as in *Callichirus*' species.

In this sense, a brief comment arises from the critical revision realized by FELDER and DWORSCHAK (2015) about the description of *C. santarosaensis* as a new species. These authors dispute the validity of *C. santarosaensis*, mainly because the new species is erected from a damaged specimen probably in juvenile phase. According to FELDER and DWORSCHAK (2015), most diagnostic characters of *C. santarosaensis* fit to the morphology of juvenile specimens of *C. major* (p. 269, figure 2c-f). We are in agreement with this argument, but there are other characters figured by SAKAI and TÜRKAY (2012) that clearly differs between these two species. For instance, in *C. santarosaensis* the male second pleopod is biramous with the endopod underdeveloped (SAKAI and TÜRKAY, 2012: p. 747, figure 10h), while in *C. major* is biramous with the endopod and exopod notoriously developed (RODRIGUES, 1971: p. 196, figure 17). This character is morphologically conserved between juvenile and adult phase in

members of *Callichirus*, therefore we believe that such feature may be used to separate *C. santarosaensis* from *C. major*.

Male and female of *C. seilacheri* can be distinguished from each other by the morphology of the first pair of pleopod (bi-segmented in males but tri-segmented in females), presence/absence of extremely dissimilar first chelipeds (highly dissimilar in adult males but not in females and juveniles from both sexes), and presence/absence of orange or dark red ovaries – depending upon developmental stage – (exclusively present in adult females). The last two features only can be used to separate males and females in adult stage. Presence of one further gonopore on the fifth pereiopod in females of *C. seilacheri* does not make difficult the sexual determination in this species when the criterion used is the morphology of the first pleopod (see Figure 3C, D).

Females in *C. seilacheri* showed two pair of gonopores: one pair functional on the coxal segments of the third pereiopod and an additional pair non functional on the coxal segments of the fifth pereiopod. The presence of gonopores on the fifth pereiopod in females of *C. seilacheri*, as has been described universally for males of most decapods (FELGENHAUER, 1992), suggests the existence of a testicular part of ovaries in the feminine gonad. Our observations, however, showed the contrary. There no testicular tissue in the feminine gonad and neither masculinization in females of this species.

Usually, specimens of decapods with gonopores on the third and fifth pereiopods have been called intersex, albeit the intersexuality and hermaphroditism are two terms usually confused in literature (FORD, 2012). The first is an abnormal condition, while the second a sexual system (CORREA and THIEL, 2003). The intersexuality is a condition in that one individual develops simultaneously male and female characteristics either externally (e.g., male and female gonopores) or internally within the reproductive organs (e.g., ovitestes). Presence of intersexual individuals is an abnormal condition within a population produced, among other factors, by endocrine disrupting chemicals (COLBORN *et al.*, 1996), parasitism (RODGERS-GRAY *et al.*, 2004) and genetic abnormalities (PARNES *et al.*, 2003). Intersexuality condition non-guarantees the individual performance as male or female, or even both simultaneously. Inversely, the term hermaphrodite must only be used when transitional of intersexual forms form part of the 'normal' life history of the organism and not because of

developmental aberrations (sensu FORD, 2012). Intersex specimens has been observed in species of Upogebiidae (*Austinogebia spinifrons* [HASWELL, 1882]: SAKAI, 1984; *Austinogebia edulis* [NGOC-HO and CHAN, 1992]: NGOC-HO and CHAN, 1992; *Paragebicula edentata* [LIN *et al.*, 2001]: LIN *et al.*, 2001; *Upogebia deltaura* [LEACH, 1816]: TUNBERG, 1986; *Upogebia stellata* [MONTAGU, 1808]: PINN *et al.*, 2001; *Upogebia thistlei* [WILLIAMS, 1986]: WILLIAMS, 1986) and Callianassidae (*Callianassa aqabaensis* [DWORSCHAK, 2003]: DWORSCHAK, 2003). While KANG *et al.* (2008) in *Upogebia major* (DE HAAN, 1841) and recently SOUZA *et al.* (2017) in *C. major* reported, until now, the only cases of hermaphroditism in gebiideans and axiideans, respectively. Considering the above information and our observations on the internal and external morphology of *C. seilacheri*, the sexual system in this species should be considered as gonochoristic (i.e., all individuals in the population exhibit separate sexes throughout their lifetime), with a remarkable sexual dimorphism to level of the first pair of pleopods and pereopods. The presence of additional gonopores in females of *C. seilacheri* seems to be the vestige of a hermaphroditic condition which might had been present in a common ancestor of the *Callichirus*' species.

CONCLUSION

In conclusion, diagnostic features of *C. seilacheri* mainly include: (i) antennular peduncle article 2 reaching as far as antennal peduncle article 4; (ii) male larger cheliped with ischium strongly curved on dorsal margin, with hook on ventral margin; (iii) fixed finger with cutting edge smooth; (iv) male Plp1 uniramous and composed of two articles. *Callichirus seilacheri* is a dioecious species with a marked sexual dimorphism along their ontogeny, which is mainly expressed through the morphology of first pair of pleopod. Despite females of *C. seilacheri* have extra genital pores on the ventral coxal segment of the fifth pereopod, these latter non-functional.

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