

Tanaidaceans (Crustacea: Peracarida) from coastal waters of La Parguera and Culebra Island, Puerto Rico, with taxonomic observations

By

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ABSTRACT

This work represents a taxonomic contribution to the knowledge of the Order Tanaidacea, Crustacea from shallow waters of Puerto Rico, an order of free-living and exclusively benthic malacostracans belonging to the Superorder Peracarida. Even though tanaidaceans occur in large numbers in shallow waters with population densities for a single species often in the thousands per m², this group has been neglected in most ecological studies because of complicatedness associated with the identification of its members. Four different chapters present the new taxonomic findings as follow: 1) *Saltipedis* (*Spinosaltipedis*) *puertoricensis*, new subgenus, new species, is described from eastern Puerto Rico off Culebra Island at a depth of 28 m. The new species is the fourth representative of the genus *Saltipedis* Guțu to be described from the Western Atlantic. The new subgenus is distinguished from the currently recognized members of the subgenus *Saltipedis* Guțu by the presence of strongly developed accessory setae on the mandible between the base of the palp and the molar process. A combination of other characters that further distinguish *S. puertoricensis* from its congeners are presented, as well as keys for the separation of the females and known males of *Saltipedis*. 2) *Echinoparapseudes alfaroe*, new genus, new species, is reported and described from material collected from a depth of 28 m off Culebra Island on the eastern coast of Puerto Rico. The new genus is placed in the family Parapseudidae Guțu and is distinguished from these other genera by a combination of characters. 3) A new kalliapseudid species, *Mesokalliapseudes quadriflagellata* from La Parguera Puerto Rico is described and illustrated. Remarks on the genus *Mesokalliapseudes* are presented. 4) Two new leptocheliid tanaidaceans, *Pseudoleptochelia juliae* and *Pseudonototanaïs oglei*, are described from La Parguera and Culebra Island, respectively.

RESUMEN

El siguiente trabajo representa una contribución taxonómica al conocimiento del Orden Tanaidacea, Crustacea de aguas someras de Puerto Rico, un orden de malacostráceos de vida libre y exclusivamente bénticos pertenecientes al Superorden Peracarida. Aunque los tanaidáceos se encuentran en grandes números en aguas someras, con densidades de miles por m² de una sola especie, este grupo ha sido ignorado en la mayoría de los estudios ecológicos por las complicaciones asociadas a la identificación de sus miembros. Cuatro capítulos diferentes presentan los nuevos hallazgos taxonómicos: 1) *Saltipedis* (*Spinosaltipedis*) *puertoricensis*, nuevo subgénero y nueva especie, es descrita al Este de Puerto Rico, en la isla de Culebra a una profundidad de 28 m. Esta nueva especie es el cuarto representante del género *Saltipedis* Guţu en ser descrita para el Atlántico Oeste. El nuevo subgénero se distingue de los miembros reconocidos para el subgénero *Saltipedis* Guţu por la presencia de unas setas accesorias fuertemente desarrolladas sobre la mandíbula entre la base del palpo y el proceso molar. Una combinación de otros caracteres que además distinguen *S. puertoricensis* de sus congéneres es presentada, así como también una clave para la separación de hembras y machos conocidos de *Saltipedis*. 2) *Echinoparapseudes alfarvae*, nuevo género y nueva especie es reportada y descrita de material recolectado a una profundidad de 28 m en la isla de Culebra en la costa Este de Puerto Rico. El nuevo género se ubica en la familia Parapseudidae Guţu y se distingue de otros géneros por una combinación de caracteres. 3) Una nueva especie de Kalliapsedidae, *Mesokalliapseudes quadriflagellata* de la Parguera Puerto Rico es descrita e ilustrada. Observaciones sobre el género *Mesokalliapseudes* son presentadas. 4) Dos nuevos Leptocheliidae tanaidáceos, *Pseudoleptochelia juliae* y *Pseudonototanaïs oglei*, son descritos de la Parguera y la isla de Culebra, respectivamente.

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Andrés Giovani Morales Núñez, 2010

DEDICATION

TO MY FAMILY AND MY LOVELY "OSA" FOR BEING MY BEST SUPPORT AND
ALWAYS MAKING ME LAUGH.....

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CHAPTER I

INTRODUCTION

The Tanaidacea is an order of free-living and exclusively benthic malacostracans belonging to the Superorder Peracarida. Most organisms are small (2–5 mm long), but adults range in sizes from 0.5 to 120 mm. More than 1095 species of tanaidaceans have been described, but the order is estimated to contain several thousands of species (Dojiri and Sieg 1997; Anderson 2010). Members of this order are known in marine, brackish and fresh waters habitats around the world, with the vast majority of individuals from deep-sea environments at depths >300 m (Sieg 1983; 1986; Heard et al. 2004).

Members of the order were originally considered aberrant amphipods (Leach, 1814), isopods (“tribe Chelifera” Sars, 1882), or an independent order sharing characters with the Isopoda and Cumacea (“Anisopoda” Dana, 1852). The ordinal name Tanaidacea was established by Hansen (1895); however, the family name Tanaidae was first used by Dana (1849) and elevated to the rank of order by Claus (1888). Therefore, Dana (1849) must be considered the authority of the Tanaidacea (Heard et al. 2004; Larsen 2005). The tanaidaceans include four suborders (Sieg, 1980): Suborder Apseudomorpha with 15 families and 444 species; Suborder Neotanaidomorpha with one family and 45 species; Suborder Tanaidomorpha with 23 families and 602 species, and one extinct suborder Anthracocaridomorpha with two families and four species (Heard et al. 2004; Larsen 2005; Bird and Larsen 2009; Anderson 2010). Apseudomorpha and Tanaidomorpha have been found in all sediment conditions including cold seep environments (Larsen 2003; Larsen 2005), while Neotanaidomorpha although free-living, seems to be restricted to soft-bottom environments and depths exceeding 300 m (Larsen 2005). Neotanaidomorphans are free-living, tanaidomorphans are tube-dwellers and the apseudomorphans are mostly burrowers (Sieg 1983).

Because the tanaidacean fauna collected for this study belongs to the suborder Apseudomorpha and Tanaidomorpha, the general description presented here focuses on these suborders. The apseudomorphan body plan is usually more dorso-ventrally flattened while tanaidomorphan body plan is cylindrical (Dojiri and Sieg 1997; Larsen 2005).

The terminology of the external morphology of Tanaidacea follows the basic malacostracans plan with a carapace covering the head and the two thoracic segments (somites), maxilliped (first thoracic appendage), cheliped (second thoracopods), six free thoracic segments (pereonites) bearing pereopods, five free abdominal segments (pleonites) sometimes fused or partially fused bearing pleopods (may be present or absent), and the last or sixth abdominal segment, which bears the uropods, fused with the telson to form a pleotelson (Wolff 1956; Larsen 2003; Heard et al. 2004; Heard et al. 2009) (See Figure 1).

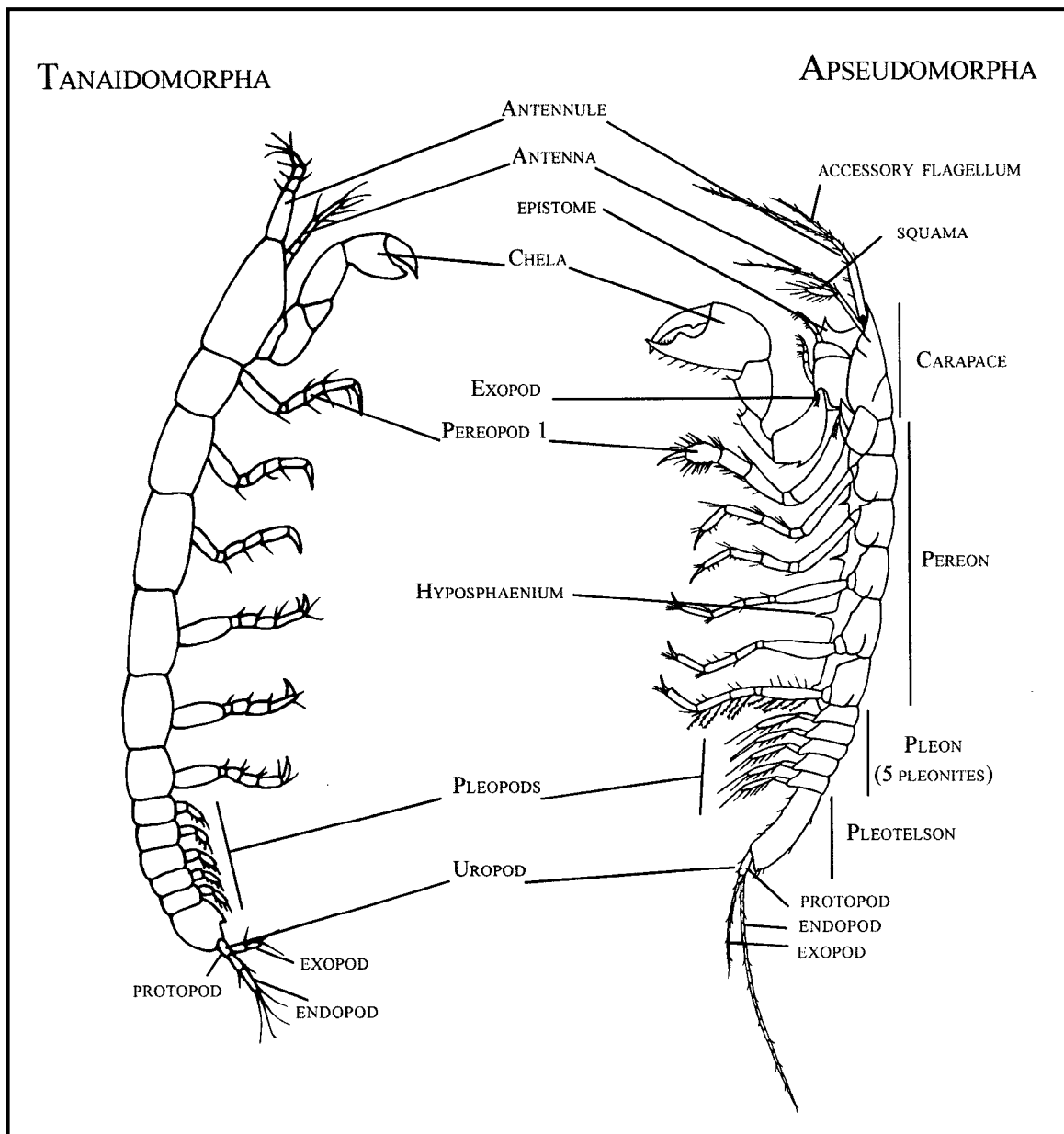


Figure 1. External morphology of generalized Apseudomorpha and Tanaidomorpha body forms (from Heard et al. 2004).

Tanaidaceans can occur in large numbers in shallow waters with population densities for a single species often in the thousands per m² (Dellile et al. 1985). For instance, Barnard (1970) found densities of the relatively large apseudomorphan species *Kalliapseudes crassu* to be over 10 000 individuals/m². The highest density has been reported for the tube dwelling tanaidomorphan *Allotanaïs hirsutus*, which occurred in numbers exceeding 140 000 individuals/m² (Delille et al. 1985). Tanaids appear to be an important dietary component for: (1) several fish species, particularly in nursery environments (larvae and juveniles); (2) migratory birds on the northern hemisphere; (3) some prawns, tanaids has been reported how the prefer prey of penaeid shrimps, (4) polychaetes, and (5) others peracarids such as isopods and amphipods (Dojiri and Sieg 1997; Heard et al. 2004; Larsen 2005).

The relatively higher abundance of tanaidaceans in the deep sea (at least when considered at the level of order), in the abyssal plain (in terms of number of species), in the continental shelf and slope, suggests that they have a great ecological importance in these zones (Gardiner 1977; Sieg and Heard 1985; Aberle and Witte 2003; Larsen 2005). The proportion of tanaids abundance apparently rises in eutrophic environments. Despite this, tanaidaceans have been neglected in most ecological surveys, and when included, the Tanaidacea figure only at the level of the order (Cosson et al. 1997; Morales-Núñez 2005).

Reason for the tanaids being ignored in most ecological surveys is largely related to problems associated with the identification of its members (Heard et al. 2004; Larsen 2005). Identifying tanaidaceans can be quite difficult, especially for the small members of the suborder Tanaidomorpha. While this is partly due to their small size, reduced morphology, and lack of relevant regional literature, the identification can be confounded by the high degree of sexual and ontogenetic variation displayed in the individuals, especially within the superfamily Paratanoidea (e.g. families Leptocheliidae Lang, 1973; Paratanaidae Lang, 1949; Pseudotanaidae Sieg, 1977). This polymorphism is a consequence of a peculiar reproductive strategy involving Protogynous hermaphroditism (Heard et al. 2004; Larsen 2005). In this case, the females may moult into males at several different instars. Therefore, males can originate from: (1) a juvenile male (primary male), (2) a female having had the first brood (secondary male), (3) a female having had two broods (tertiary male), and (4) possibly also from later development female stages. The

primary male is smaller and morphological different from females, secondary and tertiary males, which also differ from each other (Larsen, 2005).

The benthic fauna lives in a tight relationship with the substrate, and it is very important to analyze the relationship among both. The effects that the substrate has over the distribution of different species are mainly due to: (1) sediment size, (2) classification of sediments, (3) porosity, (4) capillarity of sediment, and (5) content of organic matter (Méndez et al. 1986). Grain size is important not only for the water retention capacity, but also the mouth parts in different species depend on grain size.

The tanaidacean fauna and zoogeography from the Tropical Western Atlantic (TWA) region is poorly known. The extent and boundaries of this region have been defined depending on the group of organisms under discussion (Meyer et al. 1978; Kensley and Schotte 1989). Inevitably, there is an overlap in these areas, but for this research, the following TWA region was divided in four different regions:

- **Tropical Western Atlantic:** This region was defined by Meyer et al. (1978) and extends from southeastern Florida southward along the Antillean Arc to Trinidad, and along the Brazilian coast as far south as Rio de Janeiro, and includes the Caribbean Sea, southern Gulf of Mexico, and the Bahamas Islands. For this study in particular the Tropical Western Atlantic includes only the southeastern Florida and Bahamas Islands.
- **Gulf of Mexico:** This region includes a part of the Atlantic Ocean through the Florida Straits between the U.S. and Cuba, and with the Caribbean Sea via the Yucatan Channel between Mexico and Cuba.
- **Wider Caribbean:** This region includes all the island of the West Indian chain, and North of South America and Central America.
- **Puerto Rico Areas:** This region includes all part around the Puerto Rico Island.

Most of the studies in the TWA, Gulf of Mexico and wider Caribbean region have focused on descriptions of new genus and species, with most of the published information done in specific areas. Yet, few studies have documented information on ecology, distribution, and taxonomy of tanaidaceans in these regions.

Overview of the Tanaidacea from Tropical Western Atlantic

The tanaidacean fauna of Florida has remained poorly known. The first and only illustrated identification guide for the Tanaidacea occurring in the coastal habitats and shelf waters (< 200 m) of Florida was published by Heard et al. (2004). They reported a total of 12 families, with sixth belonging to the Suborder Apseudomorpha (Pagurapseudidae, Sphyrapidae, Apseudidae, Kalliapseudidae, Parapseudidae, and Metapseudidae), and sixth belonging to the Suborder Tanaidomorpha (Tanaidae, Tanaellidae, Paratanaidae, Pseudotanaidae, Leptocheliidae, and Nototanaidae). In addition, they made a revision of the status of tanaidaceans fauna from the coastal waters of Florida (See Heard et al. 2004 Pag. 2-3). Gardiner (1973) described a new genus and new species of *Cirratodactylus floridensis* (Gardiner, 1973) from southeastern Florida, which was removed to the genus *Psammokalliapseudes* Lang, 1956. McSweeney (1982) described a new species of *Pagurapseudes largoensis* from Key Largo and Key Biscayne bay, Florida, more lately this species was removed to genus *Pagurotanais* Bouvier, 1918. Sieg (1982) originally described a new species of *Kalliapseudes bahamensis* from El Salvador Island in the Bahamas, later was removed to genus *Mesokalliapseudes* Lang, 1956. A list of the new tanaidacean described for this area is listed in Table 1.

Table 1. Alphabetical list of the new genus and new species of tanaidaceans described for the Tropical Western Atlantic.

Scientific name	Locality	New taxa
<i>Araphura higginsii</i> Sieg & Dojiri, 1989	Florida	Species
<i>Halmyrapseudes bahamensis</i> Băcescu & Guțu, 1974	Bahamas Islands	Genus & species
<i>Grallatotanais antipai</i> Guțu and Iliffe, 2001	Bahamas Islands	Genus & species
<i>Mesokalliapseudes bahamensis</i> (Sieg, 1982)	Bahamas Islands	Species
<i>Mesokalliapseudes thalasispeleus</i> Guțu, 2006	Bahamas Islands	Species
<i>Pagurotanais largoensis</i> (McSweeney, 1982)	Florida	Species
<i>Podictenius tomiliffei</i> Guțu, 2006	Bahamas Islands	Species
<i>Protanaissus floridensis</i> Larsen and Heard, 2004	Florida	Species
<i>Psammokalliapseudes floridensis</i> (Gardiner, 1973)	Florida	Species

Overview of the Tanaidacea from Gulf of Mexico

In the Gulf of Mexico region, Larsen (2005) reported and described four new genera, *Armaturatanais*, *Caudalonga*, *Insociabilitanais*, and *Pseudoarthura*, and twenty-

one new species belonging to these new genera and to genera previously described is listed in Table 2. Additionally, the author reviewed all information related to several aspects of tanaidaceans including morphology, physiology, ecology, and biology; the biological aspects of these genera have been the most taxonomic important study of deep-sea tanaidaceans from the Gulf of Mexico and the Caribbean region. Viskup and Heard (1989) published the new species of *Pseudosphyrapus siege* from Gulf of Mexico, posteriorly this species was removed to genus *Kudinopasternakia* Gutu, 1991. Larsen (2003) described the new genus and species *Crurispina insolituchelia* from Gulf of Mexico, which was removed to genus *Spinitanaopsis* Larsen, 2005. Guțu, (2006) removed the species *Kalliapseudes* (*Mesokalliapseudes*) *macsweenyi* Drumm, 2003 and placed it in the type of the monotypic genus of *Alokalliapseudes* Guțu, 2006. A list of the new tanaidacean described for this area is listed in Table 2.

Table 2. Alphabetical list of the new genus and new species of tanaidaceans described for the Gulf of Mexico.

Scientific name	Locality	New taxa
<i>Alokalliapseudes macsweenyi</i> (Drumm, 2003)	Florida	Species
<i>Anarthruopsis edentula</i> Larsen, 2005	Gulf of Mexico	Species
<i>Araphura curticauda</i> Larsen, 2005	Gulf of Mexico	Species
<i>Araphura extensa</i> Larsen, 2003	Gulf of Mexico	Species
<i>Araphura spinithenari</i> Larsen, 2005	Gulf of Mexico	Species
<i>Araphuroides bombus</i> Larsen, 2005	Gulf of Mexico	Species
<i>Armaturatanais minipodus</i> Larsen, 2005	Gulf of Mexico	Genus & species
<i>Atlantapseudes lindae</i> Meyer & Heard, 1989	Gulf of Mexico	Species
<i>Bathyleptochelia oculata</i> Larsen, 2003	Gulf of Mexico	Genus & species
<i>Calozodion heardi</i> Guțu, 2002	Florida	Species
<i>Calozodion singularis</i> Guțu, 2002	Florida	Species
<i>Caudalonga quatroleon</i> Larsen, 2005	Gulf of Mexico	Genus & species
<i>Chaulioleona faini</i> Larsen, 2005	Gulf of Mexico	Species
<i>Coalecerotanais inflatus</i> Larsen, 2003	Gulf of Mexico	Genus & species
<i>Collettea elongata</i> Larsen, 2002	Gulf of Mexico	Species
<i>Dactyloprion anakanthes</i> Guțu, 2002	Gulf of Mexico	Genus & species
<i>Filitanais filiformes</i> Larsen, 2005	Gulf of Mexico	Species
<i>Insociabilitanais ventrospinatus</i> Larsen, 2005	Gulf of Mexico	Genus & species
<i>Kudinopasternakia bispinosa</i> Guțu & Heard, 2002	Gulf of Mexico	Species
<i>Kudinopasternakia siegi</i> (Viskup & Heard, 1989)	Gulf of Mexico	Species
<i>Leptognathia gyraeae</i> Larsen, 2005	Gulf of Mexico	Species
<i>Leptognathia longimanus</i> Larsen, 2005	Gulf of Mexico	Species

Table 2 (continued)

Scientific name	Locality	New taxa
<i>Leptognathiella occidentis</i> Larsen, 2005	Gulf of Mexico	Species
<i>Leptognathiella vermiformis</i> Larsen, 2005	Gulf of Mexico	Species
<i>Leviapseudes bipartitus</i> Larsen, 2005	Gulf of Mexico	Species
<i>Meromonakantha gilrowei</i> Larsen, 2005	Gulf of Mexico	Species
<i>Mesotanais longisetosus</i> Sieg & Heard, 1989	Gulf of Mexico	Species
<i>Mesotanais vadicola</i> Sieg & Heard, 1989	Gulf of Mexico	Species
<i>Nototanoides trifurcatus</i> Sieg & Heard, 1985	Gulf of Mexico	Genus & species
<i>Parafilitanais Mexicana</i> Larsen, 2002	Gulf of Mexico	Species
<i>Paragathotanaeis medius</i> Larsen, 2002	Gulf of Mexico	Species
<i>Paranarthrura bispinosa</i> Larsen, 2005	Gulf of Mexico	Species
<i>Paranarthrura tenuimanus</i> Larsen, 2005	Gulf of Mexico	Species
<i>Paragathotanaeis spinosus</i> Larsen, 2005	Gulf of Mexico	Species
<i>Pectinapseudes (Pectinapseudes) magnus</i> Guțu, 2002	Gulf of Mexico	Species
<i>Pectinapseudes (Pectinapseudes) mesteri</i> Guțu, 2002	Gulf of Mexico	Species
<i>Pseudoarthura heardi</i> Larsen, 2005	Gulf of Mexico	Genus & species
<i>Pseudotanais (Pseudotanais) mexikolpos</i> , Sieg & Heard, 1988	Gulf of Mexico	Species
<i>Robustochelia solida</i> Larsen, 2005	Gulf of Mexico	Species
<i>Spinimanaopsis insolituchelia</i> (Larsen, 2003)	Gulf of Mexico	Species
<i>Stenotanais macrodactylus</i> Larsen, 2005	Gulf of Mexico	Species

Overview of the Tanaidacea from Wider Caribbean

In the Wider Caribbean region, Heard et al. (2009) reported that organisms belonging to the genera *Leptochelia* Dana, 1849 and *Apseudes* Lech, 1814 from the Caribbean coastal waters of Costa Rica were mentioned by Breedy (1986) in an unpublished study on peracarids of Cahuita coral reef. Posteriorly, these tanaidaceans were re-examined and finally four tanaidaceans were identified, two apseudomorphans: *Apseudes* cf. *intermedius* and *Apseudomorpha* nr. *glebosus* (Menzies 1953), and two species of *Leptochelia*: *Leptochelia dubia*, and *L. forresti*. Guțu and Gomez (1976) described the new species of *Pagurapseudes guitarte* from the southeastern shore of Cuba, which later was removed to genus *Pagurotanais* Bouvier, 1918. Stebbing (1896) described a new genus and a new species of *Dolichochelia forresti* (Stebbing, 1886) from Antigua Island that later was removed to the genus *Leptochelia* Dana, 1849. Bamber (1993) described the new species of *Kalliapseudes soniadae* from Trinidad y Tobago, after this species was removed to genus *Mesokalliapseudes* Lang, 1956. A list of the new tanaidaceans described for this area is listed in Table 3.

Table 3. Alphabetical list of the new genus and new species of tanaidaceans described for the Wider Caribbean region.

Scientific name	Locality	New taxa
<i>Apseudopsis caribbeanus</i> Guțu, 2006	Cuba	Species
<i>Apseudomorpha martinicana</i> Guțu, 2009	Martinique Island	Species
<i>Apseudomorpha ortizi</i> Guțu, 2006	Cuba	Species
<i>Ascumella caymanensis</i> Guțu & Heard, 2002	Grand Cayman Island	Genus & species
<i>Calozodion multispinosum</i> Guțu, 1984	Cuba	Species
<i>Calozodion wadei</i> Gardiner, 1973	Jamaica	Species
<i>Carpoapseudes heardi</i> Hansknecht & Santos, 2008	Trinidad and Tobago	Species
<i>Discapseudes belizensis</i> Guțu & Heard, 2002	Belize	Species
<i>Discapseudes mexicanus</i> Guțu, 2006	Mexico	Species
<i>Halmyrapseudes cubanensis</i> Băcescu & Guțu, 1974	Cuba	Genus & species
<i>Iungentitanais primitivus</i> Sieg, 1977	San Thomas Island	Species
<i>Leptochelia forresti</i> (Stebbing, 1986)	Antigua Island	Species
<i>Mesokalliapseudes soniadae</i> (Bamber, 1993)	Trinidad and Tobago	Species
<i>Pagurotanais bouryi</i> (Bouvier, 1918)	Cuba	Genus & species
<i>Pagurotanais guitarti</i> (Guțu & Gomez, 1976)	Cuba	Species
<i>Paratyphlotanais typicus</i> Kudinova-Pasternak & Pasternak, 1978	Venezuela Basin	Genus & species
<i>Pseudoapseudomorpha gomezi</i> Guțu & Ortiz, 2009	Cuba	Species
<i>Pseudoleptochelia mortenseni</i> Lang, 1973	Trinidad and Tobago	Species
<i>Pseudotanais (Akanthinotanais) mortenseni</i> Sieg, 1977	San Thomas Island	Species
<i>Pseudotanais kurchatovi</i> Kudinova-Pasternak & Pasternak, 1978	Deep Caribbean	Species
<i>Pseudotanais (Pseudotanais) baresnauti</i> Bird, 1999	Barbados	Species
<i>Saltipedis navassensis</i> Hansknecht et al., 2001	Navassa Island	Species
<i>Sphyrapoides tuberculifrons</i> Guțu & Heard, 2002	Grand Cayman Island	Species
<i>Synapseudoides pinosensis</i> Guțu & Ortiz, 2009	Cuba	Genus & species
<i>Vestigiramus antillensis</i> Guțu, 2009	Martinique Island	Genus & species
<i>Zaraza linda</i> Guțu, 2006	Dominican Republic	Genus & species

Overview of the Tanaidacea from Puerto Rico Areas

In Puerto Rico, studies on the tanaidacean fauna have lagged behind compared to other regions. No work compiled any information about this group, only specific works have been done. Messing (1977) described *Neotanais persephone* being this tanaidacean the first reported from the Puerto Rico Trench at depths greater than 6.000 m. This study included the deepest confirmed records of any known member of this genus from the Atlantic Ocean and worldwide. In shallow waters of Puerto Rico, Stoner (1986) observed that two very similar tanaidaceans, *Leptochelia forresti* Stebbing 1896 and *L. dubia* Krøyer 1842 were the most abundant macrofauna associated with the capitula of the calcareous

green macroalgae *Penicillus capitatus* Lamarck, 1813. Hansknecht et al. (2002) described a new tanaids of *Tanapseudes gutui* adjacent to the Carolina Waste Water treatment Plant (WWTP) in San Juan, Puerto Rico; this species was also found in Trinidad and Tobago in 2002. A recent study described the impact of two open-ocean submerged cages stocked with cobia (*Rachycentron canadum*) and mutton snapper (*Lutjanus analis*) on the macroinvertebrate community surrounding the marine aquaculture operation in Culebra Island, Puerto Rico during October 2002-2003 (Morales-Núñez 2005). This study found an increment in abundance of tanaidaceans and numerical dominance of this group over other infaunal invertebrates during months when feeding rates increased significantly and during the harvest periods. Moreover, Drumm & Heard (2010) reported the new ranges for some species of Kalliapseudid from the Northwest Atlantic; based on material collected in this study they included the new locality record for *Psammokalliapseudes granulatus* Brum, 1973 into Culebra Island, Puerto Rico (Caribbean Sea). A list of the new tanaidacean described for this area is listed in Table 4.

Table 4. Alphabetical list of the new genus and new species of tanaidaceans described for the Puerto Rico Areas.

Scientific name	Locality	New taxa
<i>Echinoparapseudes alfaroe</i> Heard & Morales-Núñez, (submitted)	Puerto Rico	Genus & species
<i>Leptocheliella tanaissuiformis</i> Bird & Heard, (in review)	Puerto Rico	Genus & species
<i>Mesokalliapseudes quadriflagellata</i> Drumm & Morales-Núñez 2010	Puerto Rico	Species
<i>Neotanais persephone</i> Messing, 1977	Puerto Rico	Species
<i>Paratanais rosadi</i> Morales-Núñez & Heard, (in review)	Puerto Rico	Species
<i>Pseudoleptochelia juliae</i> Morales-Núñez et al. 2010 (submitted)	Puerto Rico	Species
<i>Pseudonototanais oglei</i> Morales-Núñez et al. 2010 (submitted)	Puerto Rico	Species
<i>Saltipedis (Spinosaltpedis) puertoricensis</i> Morales-Núñez et al. 2010	Puerto Rico	Subgenus & Species
<i>Tanapseudes gutui</i> Hansknecht et al. 2002	Puerto Rico	Species

Currently, there is limited information about the distribution and taxonomy of tanaidaceans in the neotropics. Due to the lack of information on this group, this study will contribute to a better understanding of the taxonomy, diversity, ecology, and zoogeography of tanaidaceans in Puerto Rico Areas.

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CHAPTER II

Saltipedis (Spinosaltpedis) puertoricensis, a new subgenus and species of apseudomorphan (Crustacea: Tanaidacea: Parapseudidae) from coastal waters off Culebra Island, Puerto Rico, with keys and taxonomic observations.

Morales-Núñez, A.G., Heard, R.W., and Alfaro, M. 2010. *Saltipedis (Spinosaltpedis) puertoricensis*, a new subgenus and species of apseudomorphan (Crustacea: Tanaidacea: Parapseudidae) from coastal waters off Culebra Island, Puerto Rico, with keys and taxonomic observations. *Zootaxa*, 2578: 25–46.





***Saltipedis (Spinopsaltipedis) puertoricensis*, a new subgenus and species of apseudomorphan (Crustacea: Tanaidacea: Parapseudidae) from coastal waters off Culebra Island, Puerto Rico, with keys and taxonomic observations**

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Abstract

Saltipedis (Spinopsaltipedis) puertoricensis, n. subgen, **n. sp.**, is described from eastern Puerto Rico off Culebra Island at a depth of 28 m. The new species is the fourth representative of the genus *Saltipedis* Guțu to be described from the western Atlantic. The new subgenus is distinguished from the currently recognized members of the subgenus *Saltipedis* Guțu by the presence of strongly developed accessory setae on the mandible between the base of the palp and the molar process. A combination of other characters that further distinguish *S. puertoricensis* from its congeners includes: (1) rostrum having an acute tip and with lateral margins convex; (2) absence of epistomal spine; (3) setation patterns on the first pereopod, inner margin of uropodal basal article, and the pleotelson; and (4) male chela having a distinct tooth on both the fixed and movable fingers. Pending further systematic study, *Longipedis* Larsen and Shimomura is resurrected to full generic status. Keys for the separation of the females and known males of *Saltipedis* are presented. Some of the taxonomic problems defining the genus *Saltipedis* and related genera are briefly discussed.

Key words: Tanaidacea, Parapseudidae, *Saltipedis*, new species, new subgenus, Caribbean, Puerto Rico

Introduction

During an examination of benthic samples collected off the eastern coast of Puerto Rico, specimens of an undescribed apseudomorphan tanaidacean referable to the genus *Saltipedis* Guțu, 1995 were recovered. The genus *Saltipedis* Guțu, 1995 (Tribe Parapseudini Guțu, 1981) was established to receive the Brazilian species, *Apseudes paulensis* Brum, 1971 as its type. Since then 10 additional nominal species, eight from the western Pacific and Indian Oceans and two from the western Atlantic were added to the genus (see Table 1). Guțu (2006) removed *Saltipedis muelleri* Guțu, 1998 to become the type of the monotypic genus *Brachylicoa* Guțu, 2006. More recently Guțu (2008) synonymized the monotypic genus *Longipedis* Larsen and Shimomura, 2006 with *Saltipedis*. In the same publication, based largely on the presence of an acute or subacute, distolateral process on the basis and palp article 1 of the maxilliped, he transferred *Saltipedis forex* Bamber, 2005; *S. incognita* Bamber, 2005; and *S. nugaris* Blazewicz-Paszkowycz and Bamber, 2007 to the new genus *Magniaculeus* Guțu, 2008. Based on these changes *Saltipedis* presently contains seven nominal species: *S. achondroplasia* Bamber, Bird, and Angsupanich, 2003; *S. bacescui* Guțu, 1998; *S. navassensis* Hansknecht, Heard, and Martin, 2001; *S. fragilis* Larsen and Shimomura, 2006; *S. paulensis* (Brum, 1971); *S. robustispinosus* Guțu, 1996; and *S. tetracanthus* Guțu and Angsupanich, 2004 (see Table 1).

The description of this new species and comments on the taxonomy of the genus *Saltipedis* are the subject of this paper. Unless otherwise indicated, the terminology used in this report, follows that of Larsen (2003).

TABLE 1. Alphabetical listing of the nominal species of *Saltipedis* Guțu, 1995 and those previously removed from the genus, including information on distribution and depth range for the currently recognized species. Currently recognized species of *Saltipedis sensu* (Guțu, 2008).

Species	Locality	Depth (m)	Revision reference
<i>achondroplasia</i> Bamber <i>et al.</i> , 2003	Thailand	Shallow littoral	-
<i>bacescui</i> Guțu, 1998	Tanzania	8	Guțu (2008)
<i>fragilis</i> (Larsen & Shimomura, 2006) *	East China Sea	199-202	Guțu (2008)
<i>navassensis</i> Hansknecht <i>et al.</i> , 2001	North Caribbean	24	-
<i>paulensis</i> (Brum, 1971) [type species]	Brazil	17-30	Guțu (1996)
<i>robustispinosus</i> Guțu, 1996	Brazil	31-46	Guțu (1996)
<i>tetracanthus</i> Guțu & Angsupanich, 2004	Thailand	Shallow waters	-

Species removed from the genus *Saltipedis*

<i>Brachylicoa muelleri</i> (Guțu, 1998)	Tanzania	7 m	Guțu, (2006)
<i>Magniaculeus incognitus</i> (Bamber, 2005)	Australia	23.4-38.8	Guțu, (2008)
<i>Magniaculeus forex</i> (Bamber, 2005)	Australia	16-33	Guțu, (2008)
<i>Magniaculeus nugoris</i> (Blazewicz-Paszkomycz & Bamber, 2007)	Australia	22-293	Guțu, (2008)

* Formally within the monotypic genus *Longipedis* Larsen and Shimomura, 2006; is the only member of genus *Saltipedis* to lack a transverse row of setulate setae on dorsal surface of the first pleonite.

Material and methods

The specimens used in this study came from a soft-bottom benthic community in the immediate vicinity of Culebra Island located at the eastern coast of Puerto Rico (Fig. 1). They were collected by divers at a depth of 28 m using a PVC core sampler (8.8 cm in diameter). Sampling took place every other month between October 2002 and October 2003 in an area of 120 by 100 m (12 000 m²). Samples were filtered through a stainless steel sieve with a 0.5 mm mesh size and preserved in 4% formalin solution with Rose Bengal stain. In the laboratory, fixed and dyed specimens were hand sorted from each sediment sample, and preserved in 70% ethanol (Morales-Núñez and Kornicker 2007).

Type material has been deposited in the collections of the United States National Museum of Natural History (USNM), Smithsonian Institution, and the USM Gulf Coast Research Laboratory Museum (GCRL), University of Southern Mississippi. All measurements are in millimeters (mm).

Systematics**Order Tanaidacea Dana, 1849****Suborder Apseudomorpha Sieg, 1980****Superfamily Apseudoidea Leach, 1814****Family Parapseudidae Guțu, 1981****Tribe Parapseudini Guțu, 1981**

Genus *Saltipedis* Guţu, 1995 *sensu lato*

Diagnosis (emended and modified in part from Guţu 2008): Parapseudidae, Parapseudini. Thin antennular flagella in both sexes. Antenna with article 2 nearly equal or slightly shorter than either articles 4 or 5. Mandible with or without accessory setae between palp and molar process; palp with setae on all three articles. Labium with palp ovate, terminating in three narrow spiniform setae. Epistomal spine present or absent. Maxilliped with basis having rounded or spinose distolateral corner; palp with article 2 having fine setae on distolateral corner. Female cheliped slender with elongate carpus and narrow propodus. Male cheliped with carpus broad and short, propodus large and inflated. Pereopod 1 fossorial, number and shape of spiniform setae varying among species. First pleonite with transverse dorsal row of small setulate setae. Pleopods having basal article narrow with plumose setae on both margins; rami narrow with inner and outer margins parallel and bearing long plumose setae.

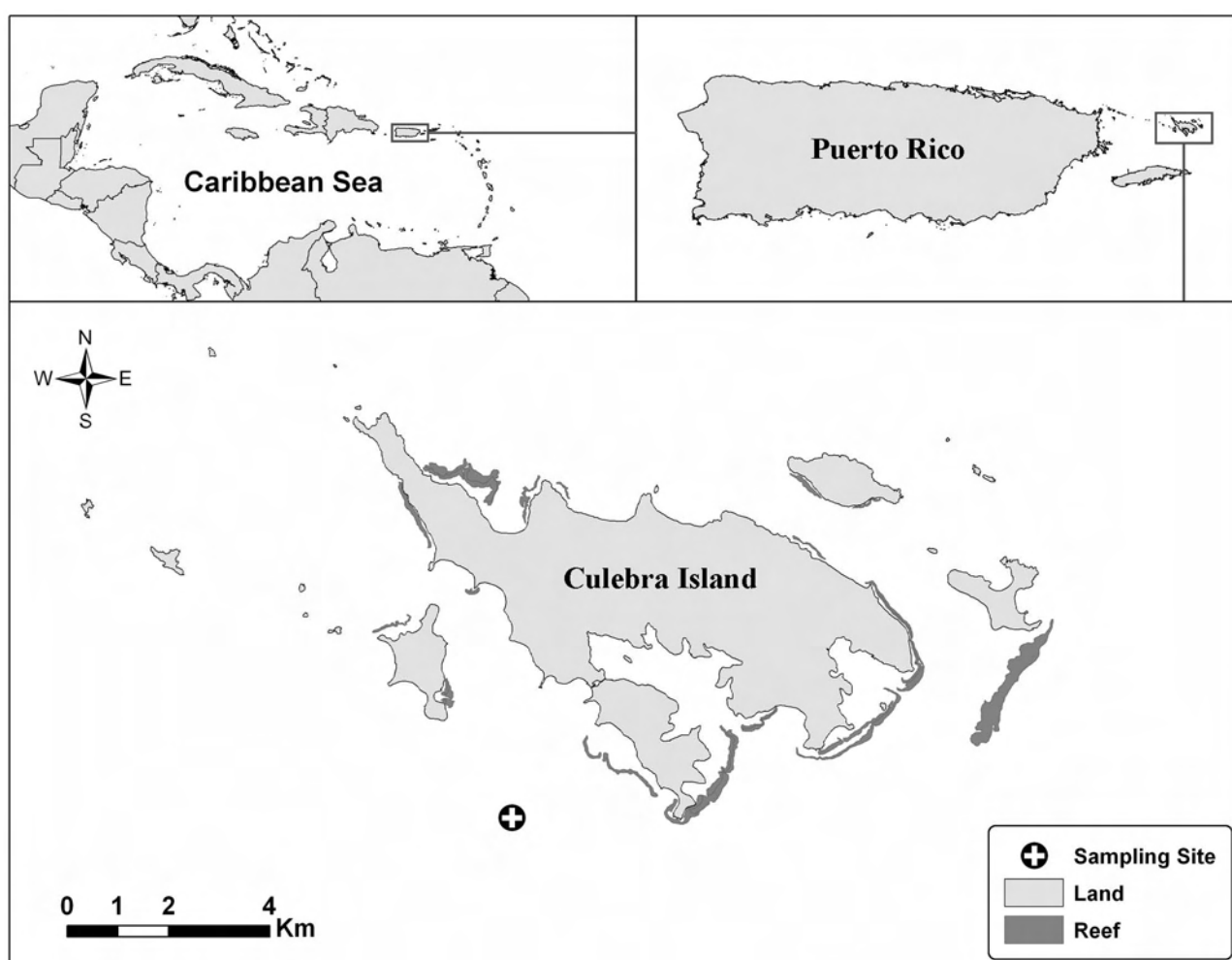


FIGURE 1. Location of Culebra Island, Eastern Puerto Rico, indicating the sampling stations where *Saltipedis* (*Spinosaltpedis*) *puertoricensis* n. subgen., n. sp. was found.

Subgenus *Saltipedis* (*Saltipedis*) Guţu, 1995

Diagnosis: Parapseudidae, Parapseudini, *Saltipedis sensu lato*. Epistomal spine usually present (apparently absent in *S. achondroplasia*). Mandible lacking accessory setae between palp and molar process. Epignath with seta on inner subdistal typical, not vestigial (length equal to greater than 1/3 width of epignath).

Type species: *Apseudes paulensis* Brum, 1971.

Subgenus *Saltipedis* (*Spinosalripedis*), new subgenus

Diagnosis: Parapseudidae, Parapseudini, *Saltipedis sensu lato*. Epistomal spine appearing absent. Surface of mandible between base of palp and molar process with six to seven distinctive, well-developed, buttressed, naked setae (Fig. 3E). Epignath with seta on inner subdistal margin minute (vestigial); length less than 1/8 width of epignath (Fig. 4E).

Type species: *Saltipedis puertoricensis*, n. sp.

Etymology: From the Greek word *Spino* = referring to spines on mandible + *Saltipedis*

Remarks: The *Spinosalripedis*, n. subgen., is characterized by a combination of the presence of unique and distinctive accessory spiniform setae on the mandible and the lack of an epistomal spine. The lack of an epistomal spine falls within *Saltipedis sensu lato* since it is also apparently absent on *S. (S.) achondroplasia* (R. Bamber, per. com. July 2009). The setation of basal article of the uropod and pleotelson (Fig. 2D) may represent additional characters, but this cannot be confirmed until reexamination of the species within the subgenus *Saltipedis*. Pending the results of future morphological and molecular systematic/phylogenetic studies for the taxa within the family Parapseudidae and related groups, we tentatively place the new Puerto Rican subgenus within the genus *Saltipedis sensu lato*. Though readily distinguished from the other species within the genus, the subgeneric status of *S. tetracanthus* Guțu and Angsupanich, 2004 remains unsettled, pending the a detailed description of its mouth parts and maxilliped.

The generic status of the *Longipedis* erected by Larsen and Shimomura (2006) is problematic. Like other members of the similar genus *Podictenius* Guțu, 2006, it apparently lacks a dorsal transverse row of setae on the dorsum of the first abdominal segment, which we tentatively consider a pivotal unifying character for the genus *Saltipedis*. For this reason, we resurrect the monotypic genus *Longipedis* for which *L. fragilis* was originally designated as the type species.

In some parapseudid taxa, however, the presence of a dorsotransverse row of setae on the first abdominal segment may be variable. For example, in genus *Parapseudes* it is present in *P. latifrons sensu* Lang 1966 and *P. arenamans* Larsen and Shimomura, 2008, but is lacking or dorsally incomplete on *P. algicola* (Shiino, 1952); *P. neglectus* Miller, 1940 (R. Heard, per. obser.) and *P. pedispinis* (Boone, 1923) (see Menzies 1953), and apparently *P. trispinosus* Guțu, 1998 (see Guțu 1998).

The occurrence of mandibular accessory setae and a dorsotransverse row of setae on the first abdominal segment distinguish *Spinosalripedis* from the otherwise similar western Atlantic members of *Podictenius* Guțu, 2006. Like *Spinosalripedis*, two of three nominal species of *Podictenius*, *P. espinosus* (Moore, 1901) and *P. tomiliffei* Guțu, 2006, are known only from the tropical waters of the western Atlantic. The third species, *P. estafricanus* Guțu, 2006, which appears quite different from its two Atlantic congeners, is known from the western Indian Ocean (Guțu 2006). Guțu (2006) considered the presence of prominent row of spiniform setae along the anteroproximal margin of the basis for the first pereopod an important generic character. Although the first pereopod of *Spinosalripedis* has a few such setae, they are smaller and less distinctive than the illustration of Moore (1901: Plate 7, fig. 4). Also, *Spinosalripedis* is differentiated from *Podictenius* by having the first pereopod bearing short, blunt conical spiniform setae (instead of acute, elongate spiniform setae) on the margins of the carpus and propodus; however, species with both these setal conditions on the first pereopod occur within the subgenus *Saltipedis* (see Figure 7).

Based on the current state of knowledge and complexity of apseudomorphan taxonomy, we believe that many of the supraspecific taxonomic designations (e.g., genera, subfamilies, and families) maybe based upon, or at least in part upon, convergent or independently derived characters. For these reasons the taxa within the suborder should be the subjects of future systematic revisions.

***Saltipedis* (*Spinosalripedis*) *puertoricensis* n. sp.**

Figs. 2–6, 7G, 8A–C, 9G; 10I

Material examined. Holotype, terminal adult male, length 5.1 mm, (USMN 1145550), 18°16'21.81"N, 65°19'09.01"W, 3.2 km Southwest of Culebra Island, Puerto Rico, depth 28 m, collected between October

2002 and October 2003. **Paratypes** (same collection data as for holotype): three males (1 terminal, 2 subterminal), three females (USMN 1145551); one male (GCRL 2981), two females (GCRL 2982, 2983). Additional specimens from the type locality are in the collection of authors.

Etymology. The species is named for the Territory of Puerto Rico, where the material used in this study was collected.

Type locality. 18°16'21.81"N, 65°19'09.01"W, 3.2 km Southwest of Culebra Island, off eastern Puerto Rico, depth 28 m, soft substrata (sand).

Distribution. Presently known only from the type locality.

Description. Adult female (with oostegites).

Body (Fig. 2A): Length about 4.3–5.2 mm, about 5.7–6.0 times as long as wide. Pereonites 1–5 with oostegites, greatly reduced, vestigial on pereonite 1. Hyposphenia lacking on pereonites 1–5, greatly reduced and inconspicuous, on pereonite 6. Pleonites with hyposphenia.

Cephalothorax (Figs. 2A–B): Carapace smooth, longer than wide, subquadrate in dorsal aspect. Rostrum with broad base becoming abruptly constricted anteriorly forming small acute tip (Fig. 2B). Ocular lobes with compound eyes having visual elements present. Second thoracomere (thoracic segment) with strongly developed hyposphenia between bases of chelipeds and directed anteriorly over the base of the maxilliped. Epistomal spine undeveloped, appearing absent.

Pereonites (Fig. 2A): Lacking spination, subquadrate in dorsal aspect, generally increasing slightly in length posteriorly; first two pereonites subequal in length; third pereonite longer than first and second; fourth widest, longer than third; fifth pereonites greater than length of any of the first four pereonites; sixth becoming narrower posteriorly, about equal in length with fifth.

Pleon (Figs. 2A, C): Width distinctly less than pereon; compressed, combined length of pleonites 1–5 about equal to that of last pereonite; pleonites decreasing slightly in width posteriorly; each pleonite about twice as wide as long; pleonite 1 with a dorsolateral row of setae; pleonites 1–3 each with ventrolateral margin tapering and forming acute posterior process; pleonites 4–5 with acute posteroventral margin; each pleonite with single hyposphenia, decreasing in size posteriorly (Fig. 2C).

Pleotelson (Figs. 2A, D): Subquadrate, about 1.2 times as long as wide, length slightly more than combined lengths of pleonites 3–5; sparsely setose with lateral margins each having two or three simple setae; apex of posterior margin with pair of small setulose setae between two longer simple setae (Fig. 2D).

Antennule (Figs. 2E–F): Peduncle of four articles: Article 1 about 2.5 times as long as wide, with eight broom setae along inner and distal margin, and numerous simple setae on both margins; article 2 about half length of first, with three sensory (two distal and one on mid-inner margin); article 3 about half length of second, with one brush-setae on distal inner margin and one near mid outer margin; article 4 shorter than third. Accessory flagellum with nine articles. Main flagellum with 13 articles, distal margins of articles 8, 10 and 12 each with single aesthetasc (Fig. 2F).

Antenna (Fig. 2G): Basal article with two setae and finely serrate inner margin. Article 2 with four short setae; article 3 with three setae (two short and one long); article 4 lacking setae; article 5 with one setae; article 6 longest (about 1.5 times as long as the article 3) with long and short seta at middle of inner and outer margins. Squama at junction of articles 2 and 3, well-developed, longer than peduncle article 2, bearing 18 long simple marginal setae. Flagellum with eight articles bearing long simple setae.

Mouthparts: Labrum (Fig. 3A): As illustrated.

Mandibles (Figs. 3B–E): Left mandible, incisor process with tip having four teeth, *lacinia mobilis* (Fig. 3D) with five teeth (distal three largest), setiferous lobe with four bifurcate setae, two distal-most short and flattened (Fig. 3C). Right mandible, similar to left but lacking *lacinia mobilis*; setiferous lobe with five setae (Fig. 3B); *Molar process* relatively slender, with grinding surface having fine denticulation (Fig. 3E). Palp with three articles; first article shortest with 3–5 simple setae, with serrate margin; second article longest, about twice that of first, with 6 simple setae on distal margin; third article longer than the first and slightly more than half second with one proximal spiniform seta, one lateral simple setae, and with eight short and one long simple setae distally (Fig. 3E). Margin between base of palp and molar process with five or six distinctive, robust, buttressed, simple setae (Fig. 3E).

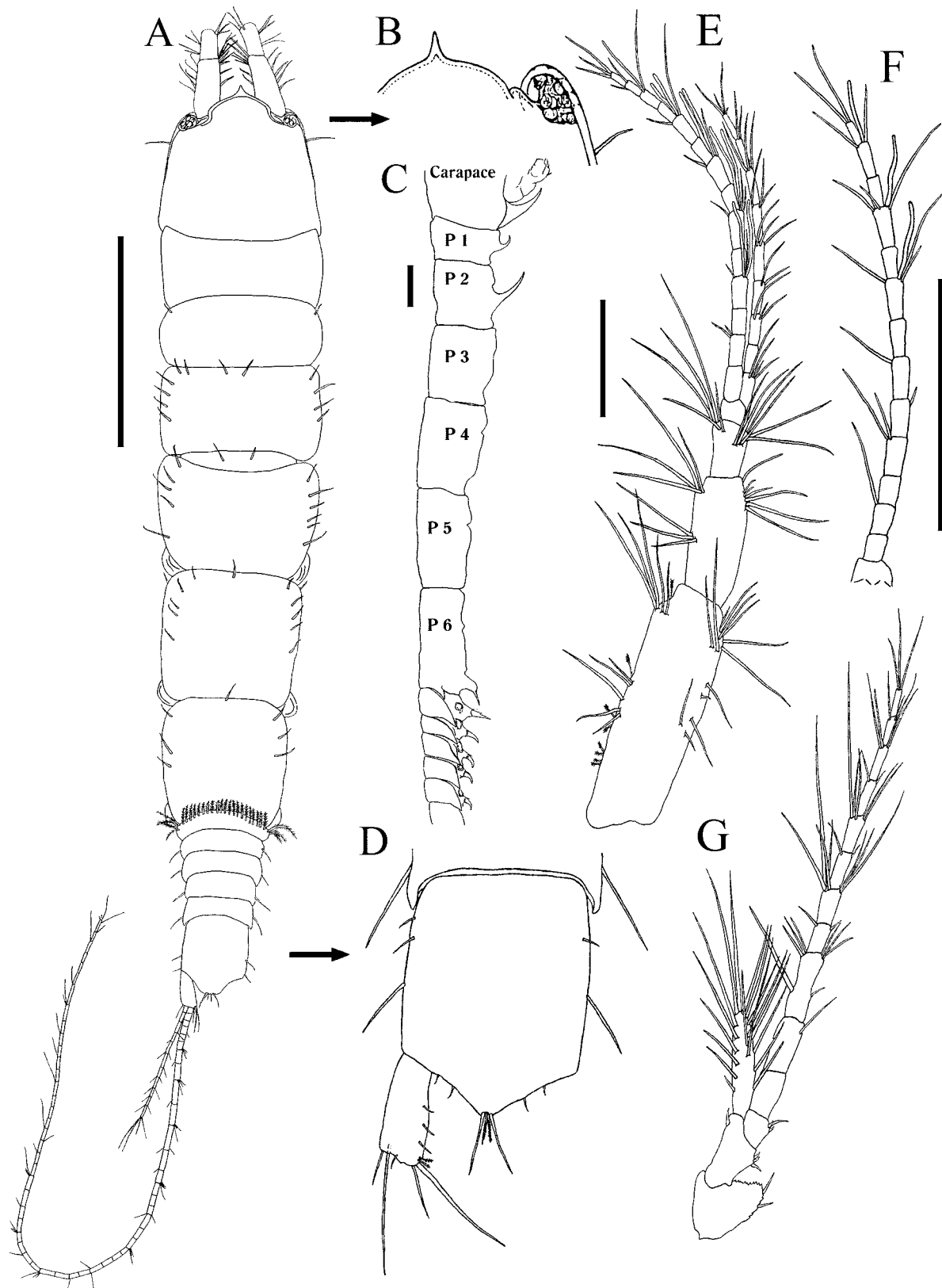


FIGURE 2. *Saltipedis* (*Spinosaltpedis*) *puertoricensis* n. subgen., n.sp., Adult female A, B, D, F, Adult male C, E, G. A, body, dorsal view; B, enlargement of rostrum; C, lateral aspect of adult male body showing hyposphaenia; D, enlargement of pleotelson; E, antennule, male; F, inner flagellum, female; G, antenna, male. Scale line: A = 1.0 mm; C = 0.3 mm; E–G = 0.5 mm.

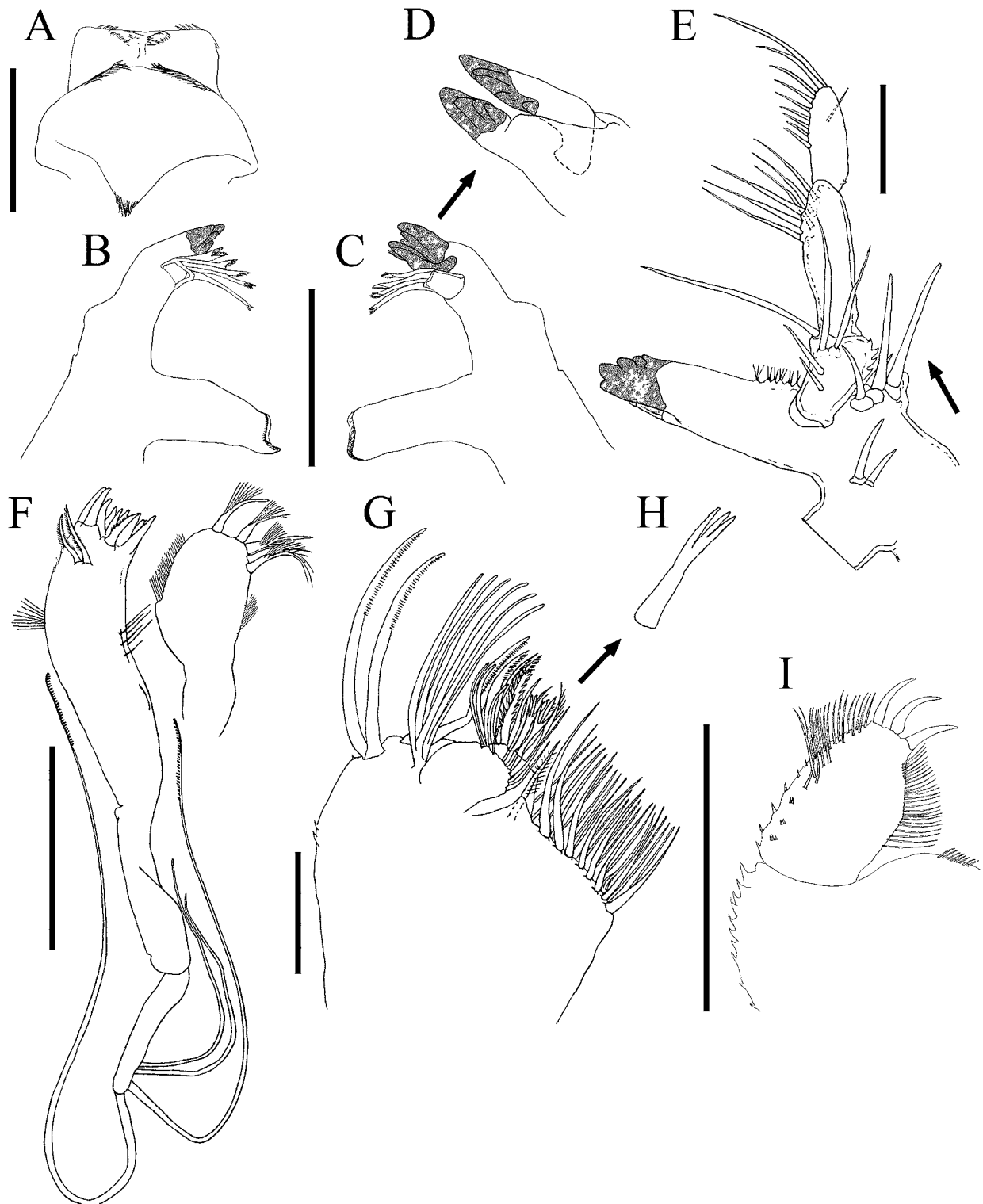


FIGURE 3. *Saltipedis* (*Spinopsaltipedis*) *puertoricensis* n. subgen., n.sp., Adult Female. A, labrum; B, right mandible; C, left mandible; D, enlargement of *lacinia mobilis* and tip of incisor process; E, mandible, excluding molar process, showing accessory setae; F, maxillule; G, maxilla; H, enlargement of trifurcate setae; I, labium. Scale line: A and F = 0.1 mm; B, C and E, = 0.5 mm; G and I = 0.2 mm.

Maxillule (Fig. 3F): Inner endite with five setulate setae, both margins finely setose; outer endite with eleven spiniform setae (at least one being serrate) and two subdistal setulate setae, margin finely setose; palp biarticulate with 4–5 distal or subdistal whip-like “cleaning” setae.

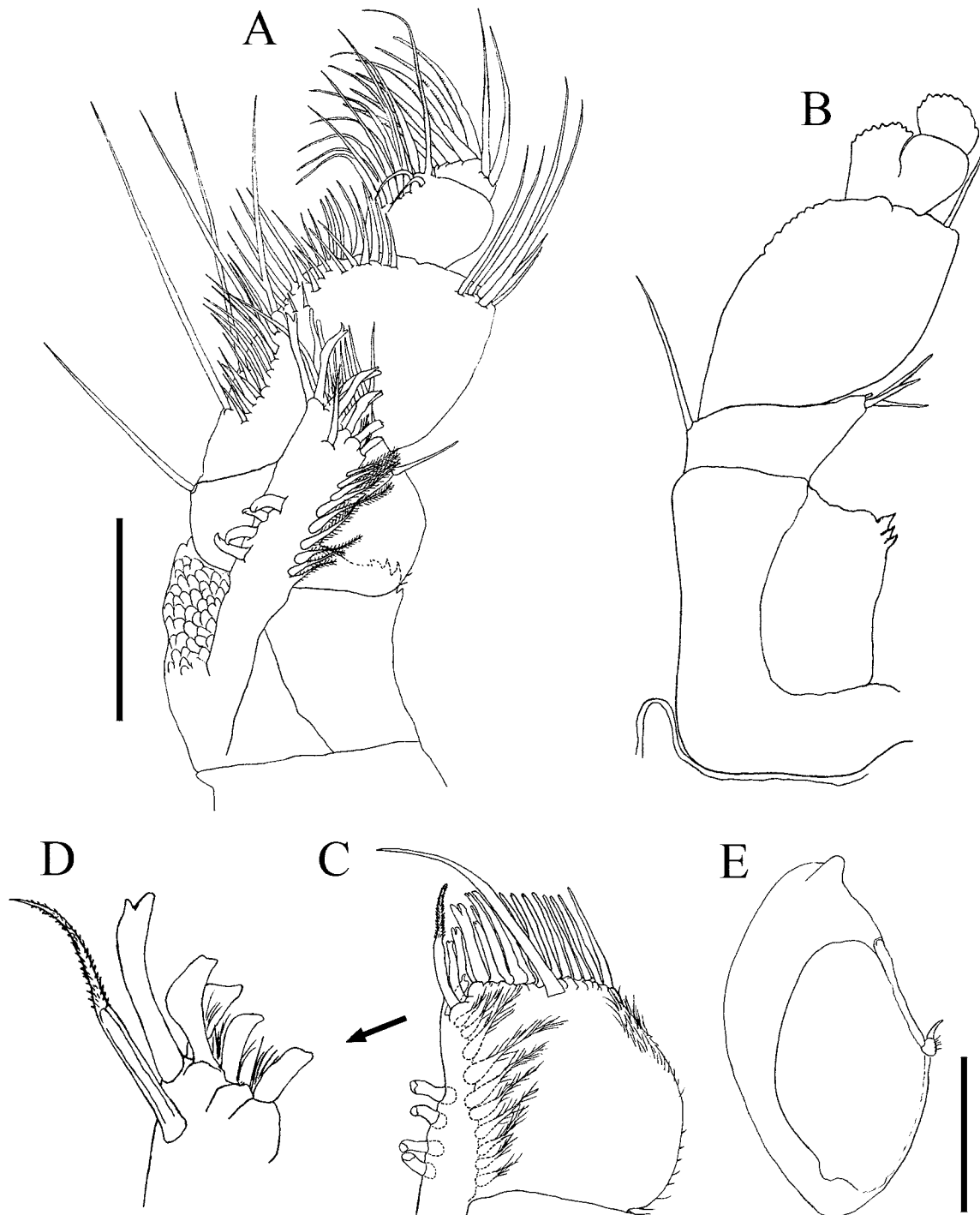


FIGURE 4. *Saltipedis* (*Spinosaltpedis*) *puertoricensis* n. subgen., n.sp., Adult Female. Maxilliped A–D: A, Maxilliped showing setation; B, inner face with inner plate, most setae excluded; C, inner plate; D, enlargement of spiniform setae from different aspect; E, epignath. Scale line: A = 0.2 mm; F = 0.1 mm.

Maxilla (Figs. 3G–H): Unexceptional, outer lobe of fixed endite with 3–4 spiniform distally trifurcate setae (Fig. 3H), and several pectinate and setulate setae; inner lobe of fixed endite with row of about 30 basally swollen setae; outer lobe of movable endite with six long simple setae and three serrated setae.

Labium (Fig. 3I): Outer margin serrate, inner margin setulose. Palp, length about 1.5 times width, distal margin with three spiniform curved setae.

Maxilliped (Figs. 4A–D): Basis, longer than wide, usually with three to five small spines on distolateral margin (Fig. 4B). Endite with 9–10 short, basally swollen, setulose setae on inner anterior margin and four

coupling hooks on the inner posterior margin (Figs. 4A, C); subdistal edge with stout seta with microspinules covering distal half; inner distal margin with “chisel-like, apically bidentate setae and multiform setae; large, curved, simple seta medially (Figs. 4C–D). *Palp*: Article 1 having long seta (about half length of article 2) on inner margin, distolateral margin attenuated with cluster of three simple setae on apex (Fig. 4B); article 2 with inner margin having two rows of setae (including four long simple setae, distolateral margin with cluster of five long simple setae and relatively short lateral seta (Fig. 4A); article 3 bilobed (Fig. 4B), wider than long, with simple attenuated and serrate setae on inner distal margin; lateral margin asetose (Fig. 4A); article 4 with two simple setae laterally, and six pectinate setae medially (Fig. 4A).

Epignath (Fig. 4E): sub-oval, cup-shape with minute, stout seta on inner subdistal margin.

Cheliped (Figs. 5A–B): Slender, smaller and much less robust than that of adult male. Basis inflated with three spiniform setae on posterior margin (proximal smallest), and two long simple setae near posterodistal margin; four or five small simple setae along anterodistal margin. Merus about half length of carpus with cluster of four simple subdistal setae lateral face; posterodistal margin with 9–10 simple setae of varying lengths. Carpus long, narrow, inserted in anteroproximal surface of merus; small distal seta near anterior margin; posterior margin with 9–10 marginal and submarginal simple setae. Propodus about half length of carpus, with cluster of four simple setae on lateral face at junction of fixed and movable finger and on distofrontal margin adjacent to base of movable finger, inner face as illustrated (Fig. 5B); fixed finger with rows and clusters of simple setae on posterolateral and inner margin near tip, grasping edge with row of 9–12 articulated “blade” setae having finely pectinate or serrate upper margins, unguis with bidentate tip for insertion of tip of movable finger; dactylus (movable finger) subequal in length to palm of propodus, with row of 6–7 pectinate blade setae along grasping edge, unguis well developed. Exopod having three articles, second article with small seta on anterior margin, third article with four plumose setae (Fig. 4A).

Pereopod 1 (Figs. 5F–G): Coxal process present, reduced to small, rounded lobe bearing three simple setae, not visible from dorsal aspect (Fig. 5G). Basis with length slightly more than twice width; anterior margin (i.e. dorsal, flexor) with proximal half having four or five small, simple setae; posterior margin with proximal 2/3 armed with four spiniform setae (distal-most smallest); posterodistal margin with stout spiniform seta and narrow simple seta. Ischium short, with three simple setae (one long, reaching over half length of carpus) on posterodistal margin. Merus slightly longer than wide; anterodistal margin having two simple setae (longest distal margin of carpus) and two acutely tipped spiniform setae (larger twice length of smaller); posterior margin with about 9–10 simple setae of varying lengths and stout, conical, spiniform seta distally. Carpus as long as wide with anterior margin having stout spiniform seta and two simple setae and submarginal oblique row of six simple setae; posterior margin with three stout conical spiniform setae (becoming smaller proximally) and seven simple setae. Propodus slightly longer than wide, anterior margin with distal half bearing three long simple setae, and two spiniform setae (largest adjacent to and over ½ length of dactylus); posterior margin with four stout conical spiniform setae (becoming longer distally) Dactylus about as long as propodus with minute setae on anterior margin proximal to unguis, four small teeth on posterior (flexor) margin; unguis simple, less than half total length of dactylus. Exopod with three articles; article 1 and 2 lacking setae, article 3 with six plumose setae (Fig. 5G).

Pereopod 2 (Figs. 6A–B): Basis about 3.5 times as long as wide; anterior margin asetose; posterior margin with small spiniform seta on proximal third and five simple setae (one short and four long) on distal margin. Ischium with length about twice width with posterior margin having five long distal setae. Merus slightly shorter than carpus; anterodistal margin with long narrow curved spiniform seta; posterior margin having two narrow spiniform setae and nine setae of varying length. Carpus slightly longer than propodus; anterodistal margin with three spiniform setae of differing lengths; posterior margin having three spiniform and eight simple setae, inner face with two oblique rows of long setae (Fig. 6B). Propodus subequal in length and narrower than carpus; anterodistal margin with two spiniform and two long simple setae. posterior margin with four subequal spiniform and seven simple setae. Dactylus subequal in length with propodus; anterior margin with small seta; posterior margin with seta at or near junction with unguis; unguis simple, about half total length of dactylus.

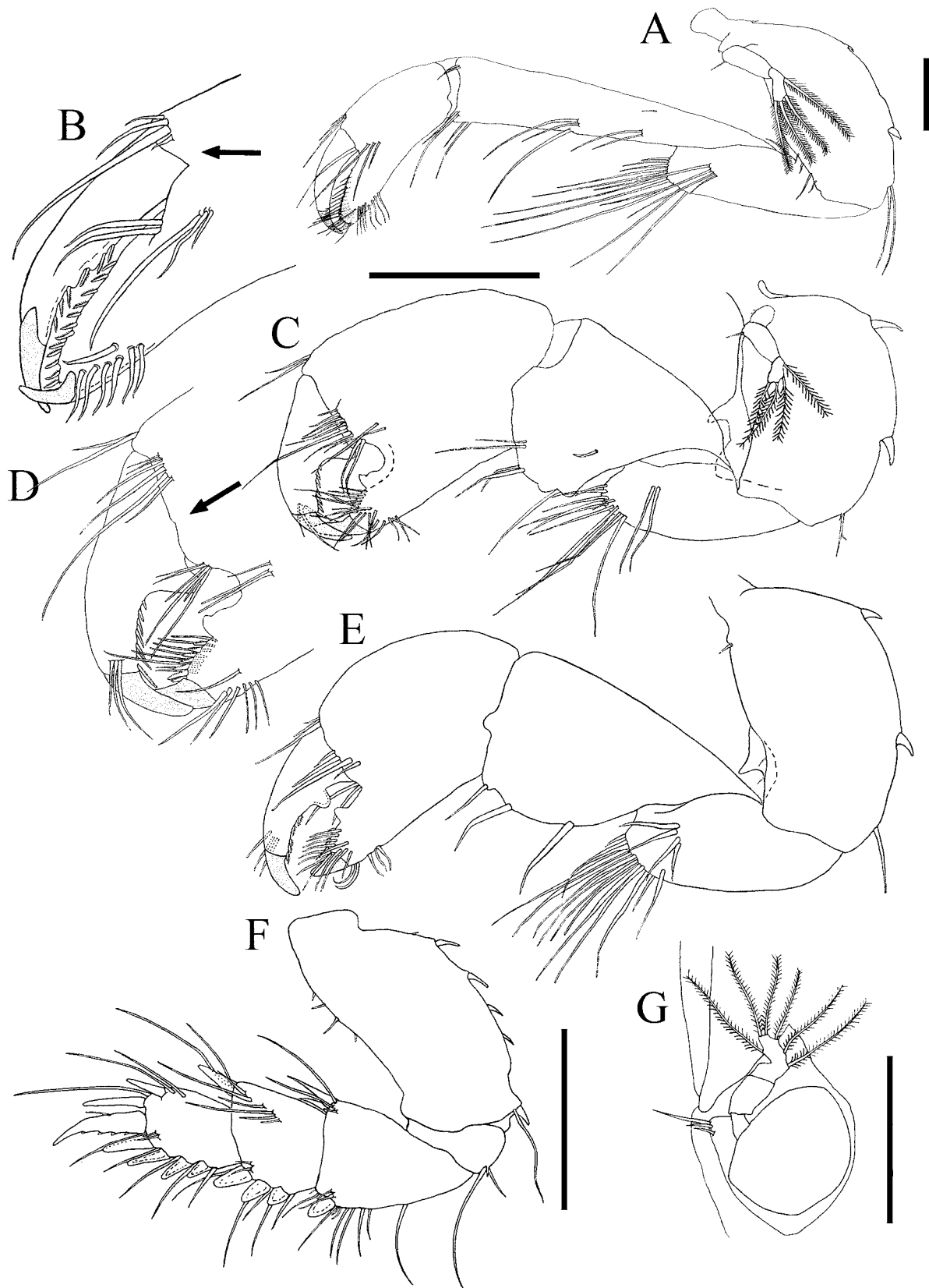
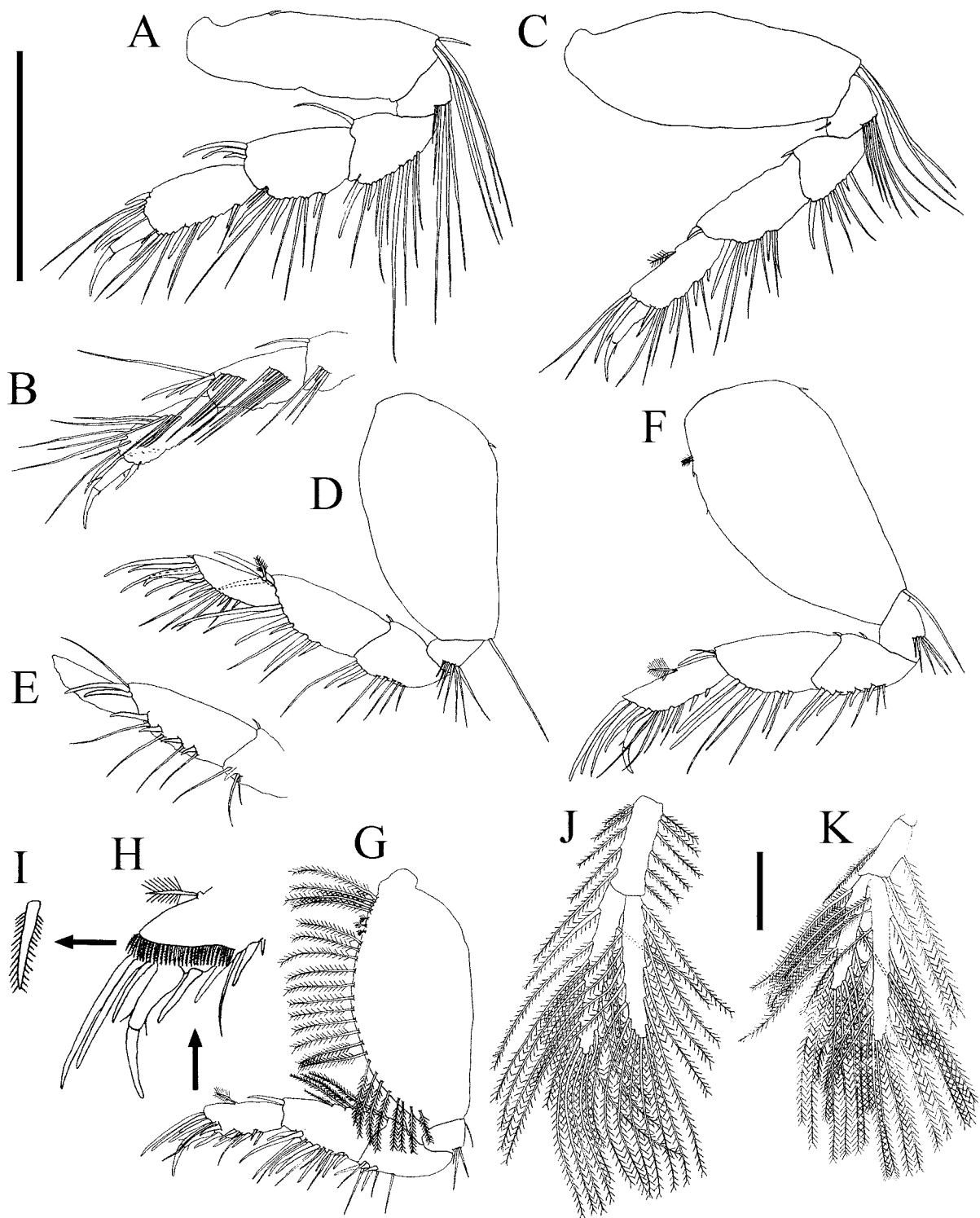


FIGURE 5. *Saltipedis* (*Spinosaltpedis*) *puertoricensis* n. subgen., n.sp., Chela, adult female: A–B: A, lateral view; B, inner aspect of half chela. Male: C–E: C, adult chela, inner distal aspect; D, adult cheliped lateral view; E, sub-adult cheliped, lateral view. F, pereopod 1, lateral view; G, exopod and reduced coxal process, ventral aspect. Scale line: A, C, E, and G = 0.2 mm; F = 0.5 mm.



A, C, D, F, G = Keep at same magnification

FIGURE 6. *Saltipedis (Spinopsaltipedis) puertoricensis* n. subgen., n.sp., Pereopods. Adult female: A, right second, lateral, view; B, right second, inner view of merus, carpus, propodus, and dactylus; C, right third; D, right fourth, lateral view; E, right fourth, inner view of merus and carpus; F, right fifth, lateral view; G, right sixth, lateral view; H, right sixth, inner view of dactylus and distal part of propodus; I, setulate seta. Pleopods: J, first; K, fifth. Scale line: A, C, D, F and G = 0.5 mm; J and K = 0.2 mm.

Pereopod 3 (Fig. 6C): Basis with length about 3 times width, posterior distal margin with three long setae. Ischium slightly wider than long; anterior margin with small seta; posterior margin having seven (one distal)

setae. Merus slightly longer than wide; anterodistal margin with small spiniform seta; posterior margin with distal half bearing three spiniform and five simple setae. Carpus longer than propodus; anterodistal margin with spiniform seta; posterior margin with three spiniform and six simple setae. Propodus slightly shorter and narrower than carpus; anterior margin with broom seta medially and one spiniform and two simple setae distally; posterior and anterodistal margin with four spiniform (distal most immediately adjacent to dactylus) and six subequal simple setae. Dactylus about equal in length to propodus; anterior margin with small seta; posterior with minute seta at or near junction with unguis; unguis simple, slightly less than half total length of dactylus.

Pereopod 4 (Figs. 6D–E): Basis swollen, about twice as long as wide, with proximal spine and distal seta on posterior margin. Ischium slightly longer than wide, with seven simple setae on posterodistal margin. Merus slightly shorter than propodus, with three spiniform setae and five simple setae on posterior margin; anterior margin with distal spiniform seta. Carpus about twice as long as wide, with six spiniform and two simple setae on posterior margin; frontal margin with two spiniform setae proximally. Propodus shorter and narrower than carpus, with five acute spiniform setae and four simple setae on posterior margin; frontal margin with one broom seta and two long, acute spiniform setae proximally, and four (one small and three long) spiniform setae distally. Dactylus as in pereopods 2–3, but appearing slightly shorter.

Pereopod 5 (Fig. 6F): Similar to pereopod 4, with slight differences in setation (e.g. presence of two broom seta and minute seta on anteroproximal margin of basis and broom seta on mid anterior margin of propodus).

Pereopod 6 (Figs. 6G–I): Basis swollen, about twice as long as wide; anterior margin with 22–24 plumose setae and three small broom setae inserted between third and fourth proximal plumose setae. Ischium longer than wide, posterior margin with four simple setae (one proximal and three distal). Merus slightly shorter than carpus; frontal margin with spiniform seta on medially and plumose seta distally; posterior margin having three spiniform and four simple setae. Carpus longer than propodus; anterior margin with three or four plumose setae proximal two thirds and spiniform seta distally; posterior margin with about 10 spiniform and four simple setae. Propodus shorter than carpus; anterior margin with broom seta on distal half, (Figs. 6G–H); posterior margin with eight spiniform setae (longest adjacent to dactylus) and one simple seta; distal margin anterior to dactylus armed with three elongate spiniform setae becoming shorter posteriorly (anterior most about as long as dactylus), distolateral margin with dense row of short fringing setulate setae (Figs. 6H–I). Dactylus with minute simple seta on both anterior and posterior margins; unguis simple, slightly less than half total length of dactylus.

Pleopods (Figs. 6J–K): Five well-developed, biramous pairs decreasing in size posteriorly. Exopods and endopods uniarticulate. First pleopod with basal article having 5–6 plumose setae on each margin; exopod and endopod each with 18–20 long, plumose, marginal setae (Fig. 6J). Fifth pleopod well-developed, but smaller than first pleopod; basal article distinctly shorter than that of pleopod 1, with 1 to 2 plumose setae on each margin; exopod shorter than endopod; exopod with about 12 and endopod with about 16 long plumose marginal setae, respectively (Fig. 6K).

Uropod (Figs. 2A, D): Basal article twice as long as wide, three or four simple, setae on distolateral margin; three simple setae on distal inner margin, three small setae along inner margin (Fig. 2D). Exopod with 10–12 articles and/or pseudoarticles, distal-most article having four apical simple setae. Endopod with division of articles unclear, apparently having from 50–60 articles and/or pseudoarticles, distal-most article with three (two short and one long) simple apical setae.

Subadult female. *Body*: Usually smaller than adult female. Oostegites buds undeveloped. Thoracic hyposphenia present on pereonites 1–2, greatly reduced or appearing absent on pereonite 6.

Terminal (ultimate) adult male. *Body*: Similar to female, except slightly narrower and with hyposphenia present on pereonites 1 and 2 (Fig. 2C). Pereonite 6 having male genital cone well-developed, conspicuous, with posteriorly directed, acute tip.

Antennule (Fig. 2E): Similar to that of female, but with main flagellum usually having 14 articles, distal margins of articles 4, 6, 8, 10 and 12 each with pair of aesthetasc.

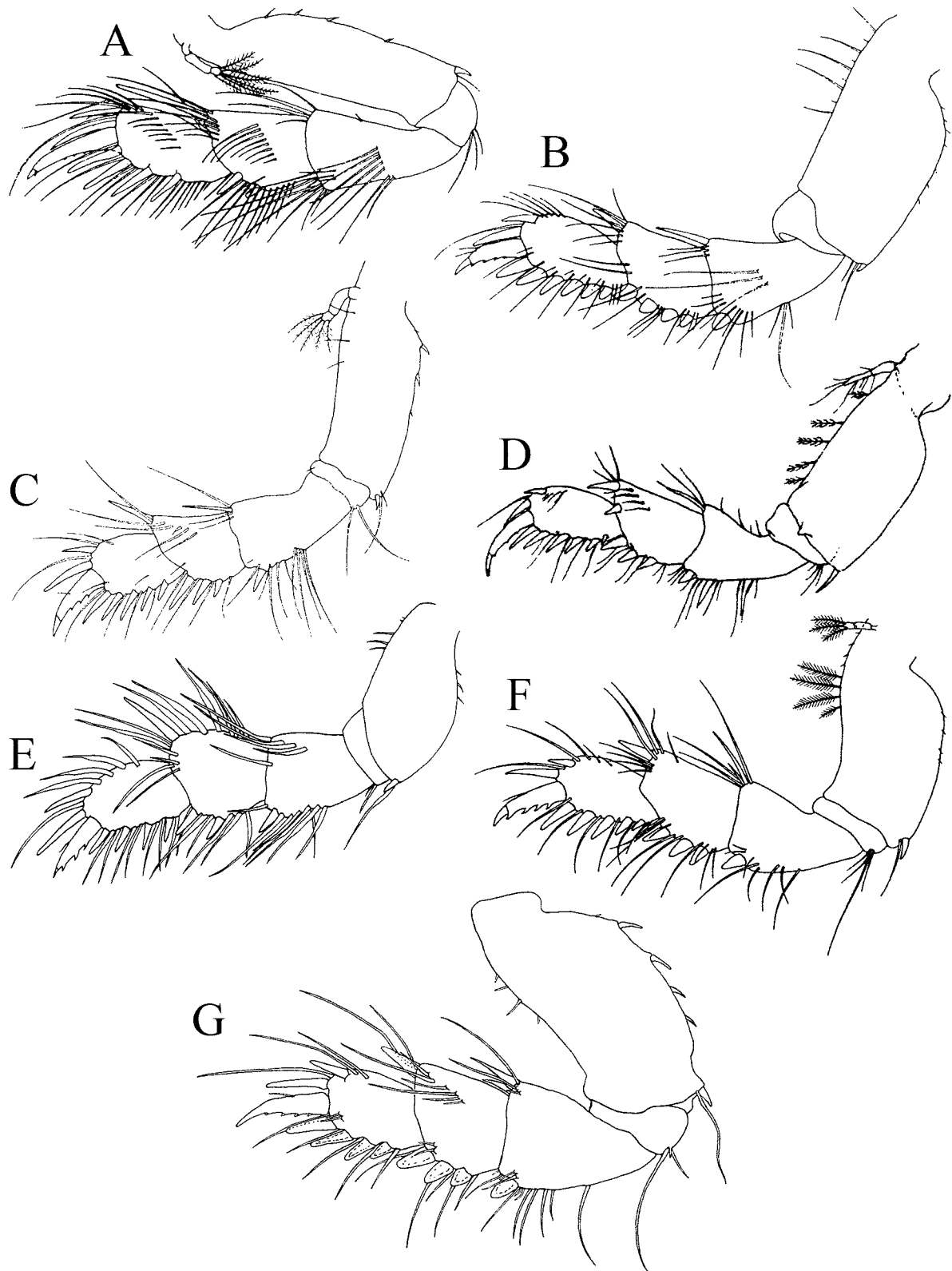


FIGURE 7. Known first pereopods for species of the genus *Saltipedis*. Except for exopods on B and E, all setae and exopods are illustrated. A, *Saltipedis paulensis*; B, *S. robustispinosus*; C, *S. bacescui*; D, *S. navassensis*; E, *S. achondroplasia*; F, *S. tetracanthus*; G, *S. puertoricensis*. [Figures modified from: Guțu 1996 (A–B); Guțu 1998 (C); Hansknecht *et al.* 2001 (D); Bamber *et al.* 2003 (E); and Guțu and Angsupanich 2004 (F)].

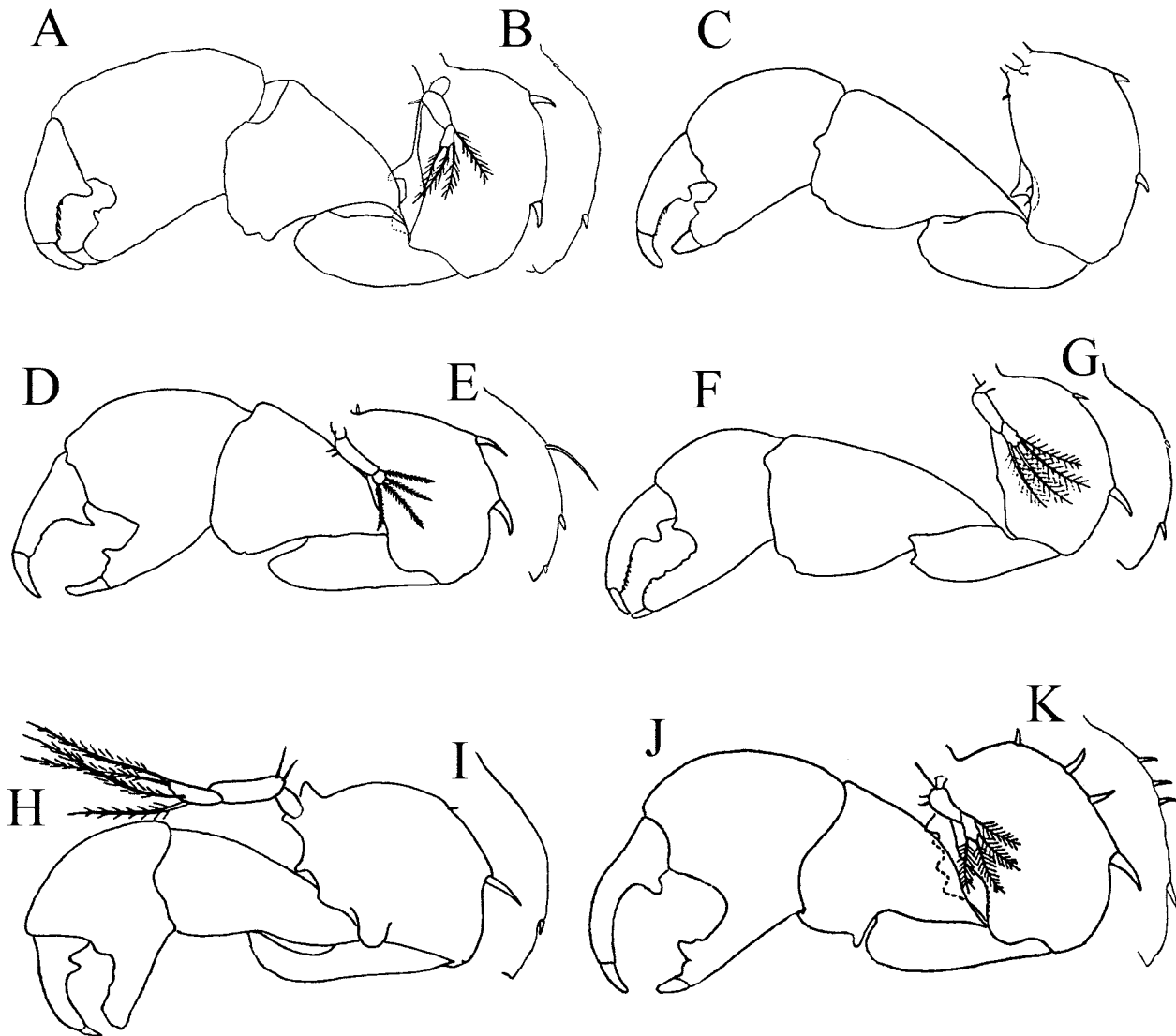


FIGURE 8. Known male chelae for the genus *Saltipedis*. Except for spiniform setae, all other setae are not shown. A–C, *Saltipedis puertoricensis*: A, adult male; B, adult female, posterior margin of basis; C, penultimate male; D–E, *Saltipedis achondroplasia*: D, adult male; E, female, posterior margin of basis; F–G, *S. bacescui*: F, penultimate? male; G, adult female, posterior margin of basis; H–I, *Saltipedis navassensis*: H, adult male; I, female, posterior margin of basis; J–K *Saltipedis tetracanthus*: J, adult male; K, female, posterior margin of basis. [Figures modified from: Bamber *et al.* 2003 (D–E); Guțu 1998 (G); Guțu 2006 (F); Hansknecht *et al.* 2001 (H–I); and Guțu and Angsupanich 2004 (J–K)].

Cheliped (Figs. 5C–D): Robust, distinctly more massive than in female. Basis with anterior region excavate (for insertion of anterior or extender part of carpus) forming lateral and inner margins; inner medial margin with blunt spine or tubercle; posterior margin having two stout spiniform setae, and three (one short and two long) distal setae. Merus with posterior margin having cluster of 9–12 simple setae; lateral face with pair of simple setae. Carpus deeper than long, posterior margin with 5–6 setae (one proximal and two distal) and three ventral setae (one proximal and two distal), small seta subproximally on lateral face. Propodus stout with fixed finger having well-developed, weakly bidentate tooth; edge between tooth and unguis with row of five to six articulated "blade" setae with finely pectinate or serrate upper margins (as on female chela), and six to seven simple setae; unguis small, brownish (Fig. 5D). Dactylus with large, blunt, proximal tooth; six spines on anterior margin, and two simple setae lateral on distal margin; unguis well developed, brownish. Exopod with three articles: article 1 with two small spiniform setae; article 2 with small simple seta near anteroproximal margin; article 3 with four plumose setae.

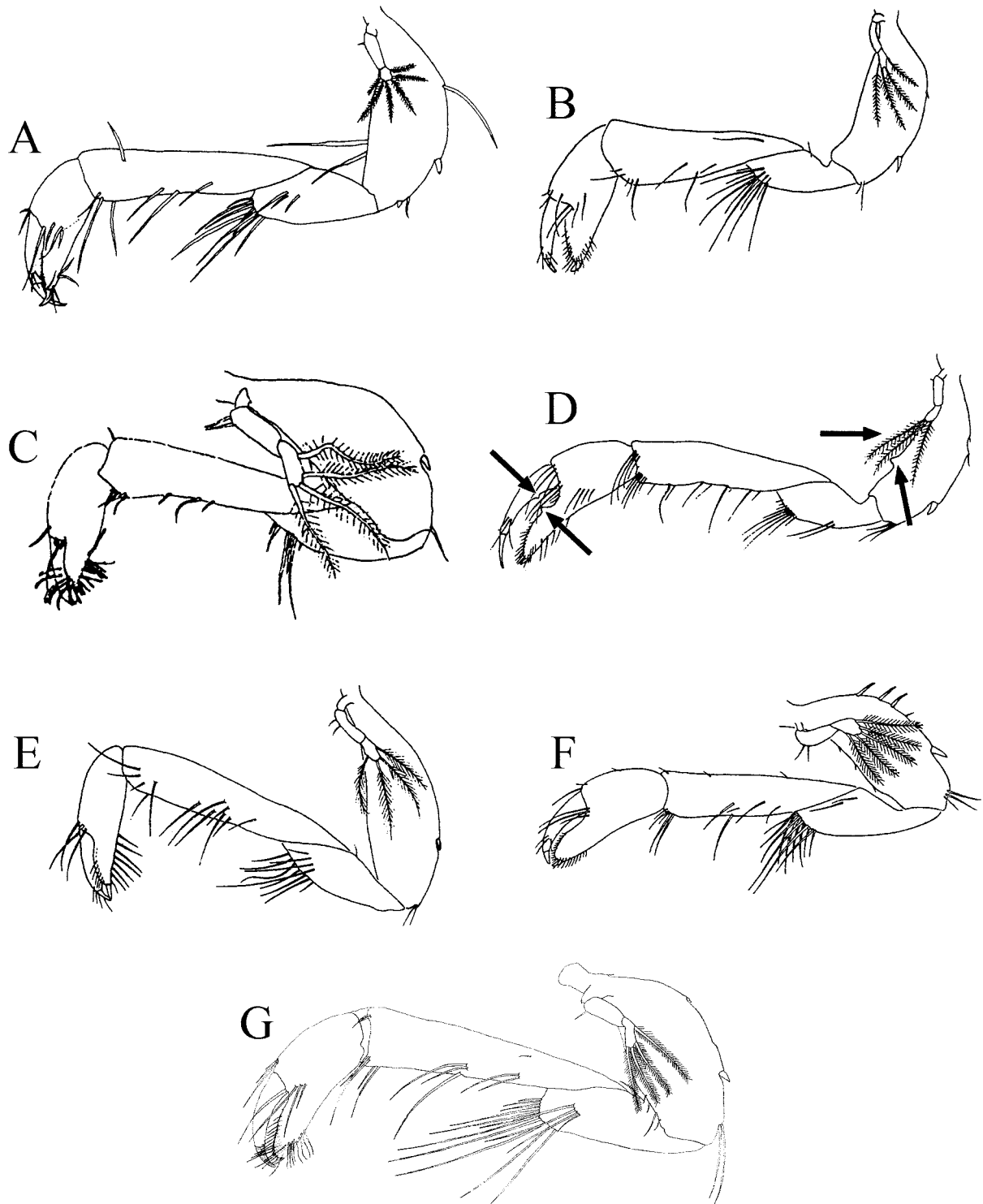


FIGURE 9. Known female chelipeds for *Saltipedis*. A, *S. achondroplasia*; B, *S. bacescui*; C, *S. navassensis*; D, *S. paulensis*; E, *S. robustispinosus*; F, *S. tetracanthus*; G, *S. puertoricensis*. [Figures modified from Bamber *et al.* 2003 (A); Guțu, 1998 (B); Hansknecht *et al.* 2001 (C) Guțu 1996 (D–F); and Guțu and Angsupanich 2004 (G)].

Penultimate male. *Body:* Setation similar to adult male. Chela (Fig. 5E) smaller, appearing more attenuated, and less robust than adult male, length of palm about 1.3 that of depth; carpus having length about 1.5 that of depth.

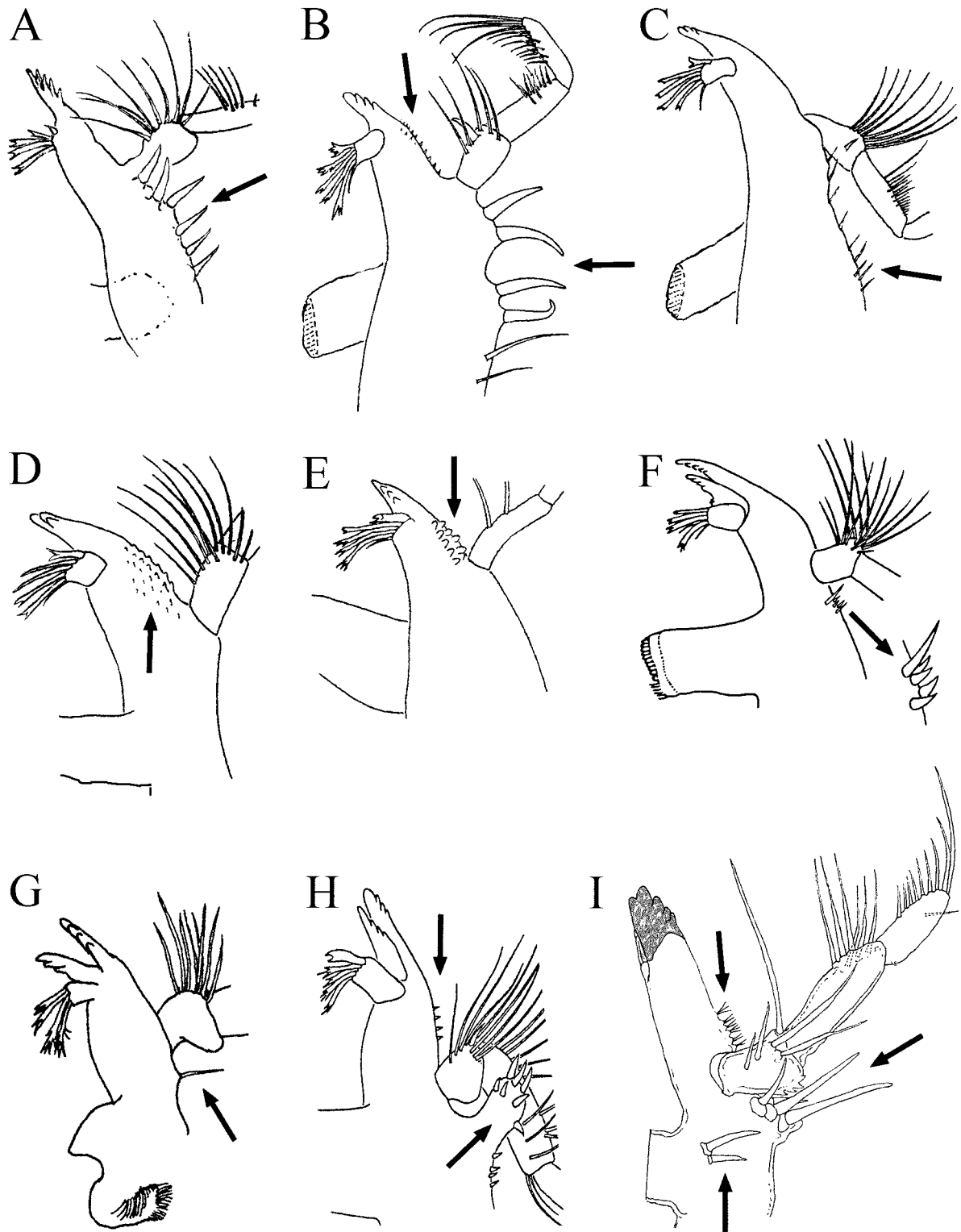


FIGURE 10. Examples of apseudomorphan mandibles having accessory simple or spiniform setae between base of molar process and palp and examples of species with small tubercles on the convex margin of incisor process between palp and setiferous row. A, *Pectinapseudes carolinensis*; B, *P. mesteri*; C, *P. magnus*; D, *P. sicilianus*; E, *Paraleiopus macrochelis*; F, *Platylicoa setosa*; G, *P. pectinis*; H, *Biopalostoma spiniferum*; I, *Saltipedis* (*Spinosaltpedis*) *puertoricensis*. [Figures modified from: Băcescu and Williams 1988 (A); Guțu 2002 (B–C); Guțu 2006 (D); Guțu 1996 (E); Guțu 2006 (F); Bamber, 1998 (G), and Guțu and Angsupanich 2004 (H)].

Remarks. *Saltipedis* (*Spinopsaltipedis*) *puertoricensis* n. sp., is distinguished from five of the six species currently attributed to the genus by its mandible having robust simple setae along the margin between the base of the palp and middle region at the base of molar process. The presence or absence of such setae is undetermined for *S. tetracanthus*, since its mouth parts (e.g., mandibles, maxilla 1 and 2 and maxilliped are presently undescribed). The females of *S. puertoricensis*, however, can be distinguished from those of *S. tetracanthus* by (1) the first pereopod having the inner frontal margin of basis with three (instead of one) blunt tubercles, and the posterior margin of the propodus armed with four (instead of five) stout spiniform setae and (2) the presence of a few simple (rather than plumose) setae on the frontal margin of the basis. The apparent absence of an epistomal spine on *S. puertoricensis* and *S. achondroplasia* distinguishes them from the other members of *Saltipedis*. Table 2 and the Keys A–C may be used to further distinguish *S. puertoricensis* from the other six currently recognized members of the genus.

TABLE 2. Some distinguishing characters for the species of *Saltipedis* based on the first pereopod (for carpus and propodus the number of spiniform setae on the anterior /posterior margins are indicated).

Species	Carpus	Propodus	Basis	
			Anterior margin	Posterior margin
achondroplasia	1/2*	2/4	Few simple setae	3 small simple setae
bacescui	1/2	2/5	Few simple setae	2 small stout setae
navassensis	2/3	2/5**	4-5 plumose setae	No medial stout setae
paulensis	1/2	2/4	No evident setae	4 small stout setae
puertoricensis	1/3	2/4	Few simple setae	3-4 spiniform setae
robustispinosus	1/4	1/6	Few simple setae	Few minute simple setae
tetracanthus	1/3	2/5	Few plumose setae	Few small simple setae

* Anterior (Frontal) margin/Posterior margin; **A minute, proximal, submarginal spiniform setae not included.

Podictenius (“*Apseudes*”) *espinosus* (Moore 1901), which was described from St. Thomas in the Virgin Islands (Richardson 1905), was incompletely described and inadequately illustrated. Its description is based on a single female holotype collected at depth of about 53 m (“20 fathoms”) about 60 km east of the type locality for *S. puertoricensis*. Based on Moore’s incomplete illustrations, *P. espinosus*, at least in some aspects, superficially resembles *S. puertoricensis* (e.g., shape of rostrum and body form). The lack of dorsal setation on the first abdominal segment and the stronger developed row of spiniform setae on the frontal margin of the first pereopodal basis (Moore 1901, Plate 7, figs. 1 and 4) appears to distinguish *P. espinosus* from *S. puertoricensis*. Notwithstanding *P. espinosus* needs to be carefully reexamined and redescribed to determine if it is correctly referable to *Podictenius* and to remove any reservations about its status in relation to *S. puertoricensis*.

Key A. Separation females for the currently recognized nominal species of the genus *Saltipedis* Guțu, 1995

- 1 Pereopod 1 with posterior margins of carpus and propodus with four and six stout spiniform setae, respectively (Fig. 7B) *S. robustispinosus* Guțu, 1996 [Brazil]
- Pereopod 1 with posterior margins of carpus and propodus with three or fewer and five or fewer spiniform setae, respectively 2
- 2 First pereopod with carpus having distoanterior margin armed with two stout spiniform setae (Fig. 7D) *S. navassensis* Hansknecht, Heard, and Martin, 2001 [Caribbean]
- First pereopod with carpus having distoanterior margin armed with one stout spiniform seta 3
- 3 First pereopod with carpus having two stout spiniform setae on posterior margin 4
- First pereopod with carpus having three stout spiniform setae on posterior margin 6
- 4 First pereopod with propodus having posterior margin armed with five stout spiniform setae (Fig. 7C) *S. bacescui* Guțu, 1998 [Tanzania]

- First pereopod with propodus having posterior margin armed with four stout spiniform setae..... 5
- 5 Cheliped of female with anterior margin of basis having blunt spine or tubercle; fixed and moveable fingers each with small tooth (Fig. 9D)..... *S. paulensis* (Brum, 1971) [Brazil]
- Cheliped of female with anterior margin of basis lacking blunt spine or tubercle; fixed and movable fingers lacking tooth (Fig. 9A) *S. achondroplasia* Bamber, Bird, and Angsupanich, 2003 [Thailand]
- 6 Mandible with 5–6 stout accessory simple setae between the base of palp and base of molar process (Fig. 3E, 10H). First pereopod with posterior margin of propodus having four short, stout spiniform setae (Fig. 5F, 7G). Epistomal spine undeveloped *S. puertoricensis*, **n. sp.** [Puerto Rico]
- Mandible with lacking accessory buttressed naked setae between the base of palp and base of molar process. First pereopod with posterior margin of propodus armed with at least 5 short, stout spiniform setae (Fig. 7F). Epistomal spine present, distinct *S. tetracanthus* Guțu & Angsupanich, 2004 [Thailand]

1. Differences in the setation of the first pereopod. The known species of *Saltipedis* display considerable interspecific variation in the numbers and shapes (i.e. short, long, stout, conical, acute) of the spiniform setae on the first pereopods (see Fig. 7). This degree of interspecific variation in these setal characters appears to be diverse as those exhibited by several other genera within the Tribe Parapseudini. The first pereopod of some species, especially that of the *S. paulensis* (Fig. 7A), have relatively long acute spiniform setae on the propodus, carpus, and merus, while others such as western Atlantic species, *S. robustispinosus* and *S. puertoricensis*, have stout, short, and blunt spiniform setae (Figs. 7B, and 7G, respectively).

Like the chelipeds and first pereopods, the second through sixth pereopods exhibit an array of diverse setal types and patterns making each distinctive enough for identification of the species to which it belongs (Fig. 7). We have presented examples of keys for the separation of the species of *Saltipedis* using characters displayed by the chelipeds or first pereopods since they are usually retained on specimens after the sieving and storing of samples; whereas, pereopods 2–6 are often lost during these processes.

2. Male cheliped forms exhibited by the genus *Saltipedis sensu lato*. *Saltipedis (Spinopaltipedis) puertoricensis*, **n. sp.**, represents the fifth nominal species of the genus for which the male is known. The male chelipeds of these five species (i.e. *S. achondroplasia*, *S. bacescui*, *S. navassensis*, *S. tetracanthus*, and *S. puertoricensis*) are somewhat similar, but can be distinguished by differences in the setal patterns on the basis and the dentition of the fixed and movable fingers (see Key B). Of these, three species, *S. puertoricensis*, *S. achondroplasia*, and *S. tetracanthus* have a tooth present on the fixed finger (Figs. 8A, 8D and 8J, respectively). Based on the setation of the posterior margin of the basis, the male cheliped of *S. puertoricensis* appears most similar, at least superficially, to that of *S. achondroplasia* (Figs. 8A, D). In contrast the presence on the basis of four tubercles on the frontal margin and four distinct spiniform setae on the posterior margin distinguishes *S. tetracanthus* from *S. puertoricensis* the other species of this genus, as well as, the other parapseudids of the Tribe Parapseudini for which males are known (Figs. 8J, A).

The males of *Saltipedis bacescui* and *S. navassensis* lack a tooth on the fixed finger, and have a similar setal pattern on the posterior margin of the basis, but they differ in overall shape and the in the presence [i.e. *S. navassensis*] or absence [i.e. *S. bacescui*] of tubercles on the frontal and distolateral margins (Figs. 8H, F). Based on its overall less compact shape, especially the relatively elongate carpus (Fig. 8F), the male cheliped illustrated by Guțu (2006) for *S. bacescui* is reminiscent of the penultimate male cheliped of *S. puertoricensis* (Fig. 8C). This indicates the possibility that Guțu's figure of *S. bacescui* may not represent the terminal male form. If so, a comparison of chelipeds of *S. bacescui* and *S. navassensis* would be much less meaningful. Notwithstanding this, the distinctive distolateral lobe on the basis and apparent lack of an unguis on fixed finger of *S. navassensis* appear to be unique (Fig. 8H), at least in comparison to the known males of *Saltipedis* and other related parapseudid genera.

Key B. Separation of known males for the genus *Saltipedis* Guțu, 1995 based on the cheliped.

- 1 Fixed finger lacking a tooth. Posterior margin of basis having two to four distinct spiniform setae, the proximal most being larger than the distal-most 2

- Fixed finger with tooth. Posterior margin of basis having two spiniform setae, proximal most very small or minute 3
- 2 Fixed finger apparently lacking unguis. Basis with anterior inner margin with subacute tubercle; disto-lateral margin with distinct lobe or tubercle. Exopod having article 2 with two small simple setae on proximal margin (Fig. 8H)
..... *Saltipedis navassensis* Hansknecht, Heard, and Martin, 2002
- Fixed finger with distinct unguis. Basis with anterior inner margin entire [lacking tubercle]; distolateral margin not lobate. Exopod with article 2 lacking setae (Fig. 8F) *Saltipedis bacescui* Guțu, 1998 (see Guțu, 2006)
- 3 Basis with posterior margin having four distinct spiniform setae (Fig. 8J).....
..... *Saltipedis tetracanthus* Guțu and Angsupanich, 2004
- Basis with posterior margin having two distinct, subequal spiniform setae..... 4
- 4 Dactylus with basal tooth acute. Exopod with article 2 having two small simple setae (Fig. 8D).....
..... *Saltipedis achondroplasia* Bamber, Bird, and Angsupanich, 2003
- Dactylus with basal tooth subacute. Exopod with article 2 having one small simple seta (Fig. 8A)
..... *Saltipedis puertoricensis*, **n. sp.**

3. Female chelipeds of *Saltipedis sensu lato*. The female chelipeds of *Saltipedis* represent a range of characters as diverse as those found within the other members of the Tribe Parapseudini (e.g. *Parapseudes*; *Podictenius*). Some of the characteristics for the cheliped in conjunction with others (i.e. setation of pereopod 1, basal article of uropod, and pleotelson) may indicate that members of the genus represent polyphyletic assemblage. The following key distinguishes the seven nominal species of *Saltipedis* based on characters exhibited by the female cheliped.

The chelipeds for the females of *S. bacescui*, *S. puertoricensis*, and to a lesser degree of *S. robustispinosus* appear to share a number of features. In contrast those of *S. achondroplasia*, *S. navassensis*, *S. paulensis*, and *S. tetracanthus* each distinctively different. *Saltipedis paulensis*, the generotype, is distinguished by having (1) a tooth on the fixed and movable finger (male character), (2) a tubercle on the frontal margin of the basis, and (3) an exopod with only three plumose setae on the distal-most article (Fig. 9D). The dentition of the cheliped for *S. paulensis* immediately distinguishes it from the other species of the genus; as well as, the other genera and species within the Tribe Parapseudini. The swollen basis and setation (e.g. reduced spiniform setae on posterior margin of basis) of *S. navassensis* appears unique among *Saltipedis* species, but is reminiscent of that on the female for *Longipedis fragilis* Larsen and Shimomura, 2006. The basis of *S. achondroplasia* has a distinctive setation pattern (i.e. frontal margin with two long distally attenuated setae and posterior margin with long simple seta medially and the distal-most spiniform seta being the smallest, instead of largest) shows no resemblance to that of male (Figs. 8D–E, and 9A). In contrast, though the spiniform setae are less robust, the setation of the posterior margin of basis for the female of *S. tetracanthus* is generally similar to that of the male (Figs. 8J–K, and 9F).

Key C. Separation of the nominal species of *Saltipedis* Guțu, 1995 based on the female cheliped.

- 1 Cutting edges of fixed and movable fingers with small, but distinct tooth. Anterior margin of basis with subacute tubercle. Exopod with three plumose setae on distal article (Fig. 9D) *S. paulensis* (Brum, 1971)
- Cutting edges of fixed and movable fingers lacking tooth. Anterior margin of basis lacking tubercle. Exopod with 4–6 plumose setae on distal article 2
- 2 Posterior margin of basis with three distinct, elongate spiniform setae proximally, one short stout spiniform seta distally, and cluster of 3 subdistal simple setae. Exopod with five plumose setae on distal article (Fig. 9F)
..... *S. tetracanthus* Guțu and Angsupanich, 2004
- Posterior margin of basis without this setal arrangement. Exopod with four or six plumose setae on distal article .. 3
- 3 Basis with frontal margin armed with two long attenuated setae; posterior margin with one long simple seta proximal to spiniform setae, distal-most spiniform seta distinctly smaller than more proximal one. Exopod with six plumose setae on distal article (Fig. 9A).....*S. achondroplasia* Bamber, Bird, and Angsupanich, 2003
- Basis with frontal margin lacking long attenuated setae; posterior margin without long simple seta proximal to spiniform setae. Exopod with four plumose setae on distal article 4
- 4 Basis with posterior margin having one spiniform seta. Exopod with two small setae on outer margin of article 2... 5
- Basis with posterior margin having two or three spiniform (some may be minute). Exopod with one or without a small seta on outer margin of article 2 6

- 5 Basis swollen, with posterior margin having stout spiniform seta and one simple distal seta. Posterior margin of carpus with 1–3 medial setae (Fig. 9C) *S. navassensis* Hansknecht, Heard, and Martin, 2002
- Basis not swollen with posterior margin having small spiniform seta and two simple, distal setae. Posterior margin of carpus with medial cluster of 6–7 setae (Fig. 9E) *S. robustispinosus* Guțu, 1996
- 6 Basis having posterior margin with two spiniform setae, the proximal most one minute; subdistal pair of setae relatively short, less than 1/3 length of merus posterior margin. Exopod without seta on outer margin of article 2 (Fig. 9B) *S. bacescui* Guțu, 1998
- Basis having posterior margin with three spiniform setae, proximal most two minute; posterior margin with subdistal pair of relatively long simple setae, about 1/2 length posterior margin of merus. Exopod with one small seta on outer margin of article 2 (Fig. 5F; 9G)..... *S. puertoricensis* **n. sp.**

4. Mandibular accessory setae. The presence of "accessory setae" on the mandibular trunk between the palp and molar process in *Saltipedis puertoricensis* is not unique, since setae have been reported from this part for some members of the apseudid *Pectinapseudes* Băcescu and Williams, 1988 (see Băcescu and Williams 1988, Guțu 2002), and the parapseudid *Platylicoa* Guțu, 2006 (subfamily Parapseudinae) (see Guțu 2006, 2008).

Another parapseudid belonging to the monotypic genus, *Biropalostoma* Guțu and Angsupanich, 2004 (Tribe Pakistanapseudini Guțu, 2008), has a distinctive spinose "bludgeon -like" process adjacent to palp (Fig. 10H); but this apparently unique structure may be independently derived. The 5–6 simple "accessory setae" on *S. (S.) puertoricensis* are robust and buttressed, appearing distinctly different and longer than the thorn-shaped types occurring on *P. carolinensis* and *P. mesteri* Guțu, 2002 (Figs. 10A–B) and the row of small narrow simple setae occurring on *P. magnus* Guțu, 2002 (Fig. 10C).

The possibility of the accessory mandibular setae on *S. puertoricensis* being homologous with those found in the parapseudid genus *Platylicoa* (Tribe Pakistanapseudini), is more problematical. The presence of this character in *Platylicoa* is represented by a compact cluster of five small, stout spiniform setae in *P. setosa* Guțu, 2006 (Fig. 10F) and a single spiniform seta in *P. pectinis* (Bamber, 1998) (Fig. 10G). In *S. puertoricensis* the accessory setae, which are distinctly larger and buttressed, occur in two groups, three or four larger setae near the base of the palp and two smaller setae adjacent to the molar process (Figs. 3E, 10I). For comparison, illustrations depicting the accessory setae and/or tubercles occurring on the mandibles of the apseudids [*Pectinapseudes* (*Pectinapseudes*) *carolinensis*, *P. (P.) mesteri*, *P. (P.) magnus*, and *P. (Impectinatus) sicilianus*], the parapseudids [(*Platylicoa setosa*, *Biropalostoma spiniferum* and *S. (S.) puertoricensis*] and the kalliapseudid [*Paraleiopus macrochelis*] are presented in Figure 10.

The distinctive buttressed, accessory setae on the mandible of *S. puertoricensis* may, or may not, have the systematic significance purported for the apseudid subgenus *Pectinapseudes* and the parapseudid *Platylicoa*. Unlike the other members of its genus *Pectinapseudes*, *P. (Impectinatus) sicilianus* (Băcescu, 1980), lacks accessory setae; however, the presence of small tubercles or spinules on outer convex margin of the incisor process (between palp and setiferous row) (Fig. 10D) is one of the diagnostic characters for the subgenus (Guțu 2006). Similar tubercles are reported for other apseudomorphan taxa, including the kalliapseudid *Paraleiopus macrochelis* Brum, 1978 (see Guțu 1996) (Fig. 10E), and to a lesser extent on *Biropalostoma spiniferum* Guțu and Angsupanish, 2004 (Fig. 10H). There are also small tubercles with associated small, short, bristle setae in the same location on the mandible of *S. puertoricensis* (Fig. 10I). We believe that the presence of small tubercles or spinules between the palp and setiferous row of some species within the families Apseudidae, Kalliapseudidae, and Parapseudidae (Fig. 10) were independently derived. Further, their presence or absence appears not to be related to the presence of the "accessory setae."

Conclusions

As discussed by Guțu (2006), apseudomorphan tanaidaceans, such as those represented by *Saltipedis*, exhibit a plethora of varying characters, which due to such apomorphic factors as convergence (homoplasy) often make a systematic understanding of the various taxa represented difficult. It would appear that the progenitors of the present day Apseudomorpha were fossorial or epibenthic forms occurring in or on soft bottom substrata

(Sieg 1983). Many, if not most of the extant soft-bottom, fossorial and deep-water groups (e.g. Gigantapseudidae Kudinova-Pasternak, 1978 and most apseudids and parapseudids), appear to have retained more plesiomorphic characters, than many of the apparently more highly derived epibenthic warm-water groups (e. g. Metapseudidae Lang, 1970 and Pagurapseudinae Lang, 1970). The combinations of plesiomorphic and apomorphic features exhibited by the generally more conservative sediment-dwelling groups appear to be reliable markers for designating genera and other supraspecific taxa. But as in most apseudomorphans, the great breadth of morphological characters exhibited by *Saltipedis* and related genera (e.g. *Brachylicoa*, *Longipedis*, *Magniaculeus*, *Parapseudes*, *Platylicoa*, and *Podictenius*) makes it difficult to interpret the generic status of the taxa represented. This is especially evident when attempting to evaluate the systematic importance for such characters as the presence or absence of an acute, distolateral process on the maxillipedal basis or a dorsotransverse setal row on the first abdominal segment in relation to other possibly more unifying, but less obvious, generic characters. For these reasons apseudomorphan systematics probably will remain in flux until the eventual implementation of a reliable combination of detailed morphological and molecular systematic criteria will be established.

Acknowledgments

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CHAPTER III

Echinoparapseudes alfaroe, a new genus and new species of apseudomorphan tanaidacean (Crustacea: Peracarida: Parapseudidae) from coastal waters off Culebra Island, Puerto Rico, with keys and taxonomic observations.

Heard, R.W., and **Morales-Núñez, A.G.**, *Echinoparapseudes alfaroe*, a new genus and new species of apseudomorphan tanaidacean (Crustacea: Peracarida: Parapseudidae) from coastal waters off Culebra Island, Puerto Rico, with keys and taxonomic observations.

Echinoparapseudes alfaroe **n. gen., n. sp.**



Abstract.

Echinoparapseudes alfaroe, n. gen, n. sp., is reported and described from material collected from a depth of 28 m off Culebra Island on the eastern coast of Puerto Rico. The new genus is placed in the family Parapseudidae Guțu and is distinguished from these other genera of the by combination of characters, including (1) a triangular, apically subacute rostrum, (2) a tridentate *lacinia mobilis*, (3) a mandibular palp having article 1 with cluster of simple, distally attenuated setae, (4) a reduced coxal process on pereonite 1, (5) pereopods 1 and 2 having strongly developed, acute, spiniform seta and spine, respectively, on anterior margin of basis, (6) ischium of pereopods 2–6 armed with one, occasional two well-developed spiniform seta on the anterior margin, and (7) the lack of transverse row of small setulate setae on first pleonite. The new genus is further characterized by the presence distinctive, blunt, crenulate, rod-like, spiniform setae on the carpus and propodus of pereopods 4–6; similar to those reported for some species of the apseudid subgenus *Bunakenia* (*Extensibasella*) Guțu. A key for the separation of the parapseudid genera (excluding *Parapseudes* Sars), which lack a transverse, dorsal row of setae on the first abdominal segment and a comparison of *Echinoparapseudes*, n. gen. with the possibly related Apseudid genus *Bunakenia* is presented. *Echinoparapseudes* appears to share several synapomorphies with some species of *Bunakenia*, suggesting the possibility that these two genera may represent transitional links between the families Apseudidae and Parapseudidae.

Key words: Tanaidacea, Parapseudidae, Apseudidae, new genus & species, taxonomy, tropical West Atlantic, Puerto Rico.

Introduction

A new genus and species of apseudomorphan tanaidacean tentatively referred to the family Parapseudidae Guţu, 1981 *sensu lato* occurred in benthic samples collected from a soft bottom benthic community in the immediate vicinity of Culebra Island off the eastern coast of Puerto Rico (Fig. 1). The specimens were collected by divers at a depth of 28 m between October 2002 and October 2003 (Morales-Núñez and Kornicker 2007; Morales-Núñez et al. 2010). The description of this new genus and species of apseudomorphan with comments on the family Parapseudidae are the subjects of this paper.



Figure 1. Location of Culebra Island, Eastern Puerto Rico, indicating the sampling stations where *Echinoparapseudes alfaroe* **n. gen., n. sp.**, was found.

Type material has been deposited in the collections of the National Museum of Natural History (USNM), Smithsonian Institution, and the USM Gulf Coast Research Laboratory Museum (GCRL), University of Southern Mississippi. All measurements are in millimeters (mm). Unless otherwise indicated, the terminology used here, follows that of Larsen

(2003). Total body length (TL) is measured from the tip of the rostrum to the end or tip of the telson. Total length of dactylus includes unguis. The anterior margin of pereopods refers to the “extender margin” or frontal margin and the posterior margin refers to the “flexor margin” or ventral margin.

Systematics

Order Tanaidacea Dana, 1849

Suborder Apseudomorpha Sieg, 1980

Superfamily Apseudoidea Leach, 1814

Family Parapseudidae Guțu, 1981

Tribe Parapseudini Guțu, 1981

Echinoparapseudes, **new genus**

Diagnosis (Subadult). Apseudomorpha, Parapseudidae, Parapseudini. Carapace without spinous processes. Triangular apically subacute rostrum. Epistomal spine present. Mandible with tridentate *lacinia mobilis*, palp with article 1 having cluster of simple distally attenuated setae. Eye lobe distinct; eyes poorly developed, lacking distinct pigment, ommatidia (about 8) small, poorly formed. Pereopod 1 with strongly developed spiniform setae on anterior margin of basis, reduced coxal process present; pereopod 2 with spine on anterior margin of basis; pereopods 2–6 with ischium bearing one, occasionally two spiniform seta on the anterior (extender) margin. First pleonite lacking transverse row of small setulate setae. Distinctive, rod-like, spiniform setae present on the merus, carpus and/or propodus of pereopods 2–6.

Type-species: *Echinoparapseudes alfaroe*, **n. sp.**

Etymology: *Echino* Latin = Spiny + generic name *Parapseudes*

Remarks. Though *Echinoparapseudes*, **n. gen.**, has some affinities with the family Apseudidae, we tentatively refer it to the family Parapseudidae and place it within the Tribe

Parapseudini Guțu, 2008. This Tribe is characterized by having the free thoracic segments distinctly broader and longer than those of the abdomen, which is compressed (i.e. much shorter than thorax with the segments (somites) being distinctly wider than long). Three other genera *Brachylicoa* Guțu, 2006; *Podictenius* Guțu, 2006; and *Longipedis* Larsen and Shimomura, 2006; within the tribe Parapseudini are characterized by lacking a transverse row of dorsal setae on the first pleonite. Within the genus *Parapseudes* Sars, 1882 some species appear to have a transverse row (e.g., *P. latifrons sensu* Lang 1966) and other do not (e.g; *P. neglectus* Miller, 1940, R. Heard, per. obser.).

Echinoparapseudes, **n. gen** is distinguished from *Brachylicoa*, *Podictenius*, and *Longipedis* by having (1) pereopod 1 with a strongly developed spiniform seta on the anterior margin of the basis, (2) long rod-like setae on pereopods, and (3) pereopods 2–6 with anterior margin of the ischium armed with one, occasionally two spiniform setae. This last character is quite pronounced on the new genus; but it is not unique since similar, though usually much less developed, such setae occur on the ischium species belonging to other apseudomorphans including the apseudid genus, *Bunakenia* (see Guțu 1995, 1996; Bamber 2005) and the parapseudid genera, *Brachylicoa* (see Guțu 2006); *Saltipedis* (see Guțu 1998; Morales-Núñez et al. 2010); *Gutuapseudes* Edgar, 1997 (see Guțu and Angsupanich 2004); and *Swireapseudes* (see Guțu and Iliffe 2008). The relatively strong development for these spiniform setae on the pereopods of *Echinoparapseudes*, n. gen. might represent an adaptive feature associated with the substratum in which it occurs. It should be noted that within the genus *Parapseudes*, the anterior margin of the ischium on some pereopods bear long simple seta in some species this seta can extend well-past the merus (see Lang 1966, Shiino 1952); these long setae may be unique to *Parapseudes*, but possibly homologous with the spiniform setae discussed above. Also, in at least in one apseudid species, *Androgynella fecunda* Guțu, 2006, a plumose seta is present on the anterior face of the ischium of pereopod 6 (see Guțu 2006); this may be an independently derived character. A key to the parapseudid genera (excluding *Parapseudes* Sars, 1882), which lack a transverse, dorsal row of setae on the first abdominal segment is presented here.

A small, reduced coxal process or lobe is present on the first pereonite of *Echinoparapseudes*, but it is not visible from the dorsal aspect (Fig. 2 H). A similar greatly

reduced coxal process has been reported for a few other parapseudids (e.g., *Longipedis fragilis* Larsen and Shimomura, 2006; *Saltipedis puertoricensis* Morales-Núñez, Heard, and Alfaro, 2010). It is possible, however, that this apparently vestigial structure may have been overlooked in other parapseudid taxa.

Echinoparapseudes, **n. gen.**, appears to be closely related and possibly congeneric with “Parapseudid? species A” *sensu* Heard et al. (2004) from the eastern Gulf of Mexico. Except for the lack of a strongly-developed and dorsally visible coxal spine or process, *Echinoparapseudes* and “Parapseudid? sp. A” appear to share several synapomorphies with some members of the apseudid genus *Bunakenia* Guțu, 1995, especially those species attributed to the subgenus *Extensibasella* Guțu, 1998. These morphological similarities are most evident in the mouth parts (e.g. tridentate or bidentate *lacinia mobilis*), setation and shape of the maxilliped, and the setation of the pereopods (e.g. presence of spiniform setae on the anterior margin of the ischium for pereopods 2–6). Since members of the genus *Bunakenia* appear to share synapomorphies with them, *Echinoparapseudes* and “Parapseudid? species A” may represent transitional links between the families Apseudidae and Parapseudidae. The possible affinity of *Bunakenia* with the family Parapseudidae previously has been broached by Guțu (2006). Resolution of this question awaits further critical systematic study involving both morphologic and molecular methodologies.

Key to parapseudid genera lacking transverse row of setae on the first pleonite

1. Mandibular palp with article 1 bearing single long seta

Longipedis Larsen & Shimomura, 2000

— Mandibular palp with article 1 having 5-15 simple setae ... 2

2. Palp of maxilliped with tip of outer margin of article 1 armed with well-developed spiniform seta; outer margin of article 2 strongly developed spiniform seta (extending to midregion of article 4). *Lacinia mobilis* tridentate. Pereopod 1 with basis having anterior margin armed with strong spiniform seta, Pereopod 2 with anterior margin of basis armed with distinct spine, Basis of Pereopods 3–5 with numerous long simple setae; Pereopod 6

with anterior margin of basis bearing irregular row of long simple setae. Merus, carpus, and/or propodus of pereopods 2–6 with rod-like setae ... *Echinoparapseudes*, **n. gen.**

— Palp of maxilliped with tip of outer margin of article 1 having minute spiniform seta; article 2 with outer margin of article with simple setae only (lacking spiniform seta). Lacinia mobilis quadridentate. Pereopod 1 with basis having anterior margin of basis either armed with row of 4–8 spiniform setae or lacking spiniform setae, Pereopod 2 with anterior margin of basis lacking distinct spine. Basis of pereopods 3–5 lacking numerous long simple setae; pereopod 6 with anterior margin of basis bearing irregular row of long plumose setae. Merus, carpus, and/or propodus of pereopods 2–6 without rod-like setae ...

3

3. Pereopod 1 with anterior margin of basis armed with row of 5–12 spiniform setae often increasing in length distally. Mandibular palp with first article bearing five or six simple setae ... *Podictenius* **Gutu, 2006**

— Pereopod 1 with anterior margin of basis lacking spiniform setae. Mandibular palp with first article bearing cluster (about 15) simple setae ... *Brachylicoia* **Gutu, 2006**

Echinoparapseudes alfarvae, **n. sp.**

Figs. 2–7

Material examined

– Holotype: subadult (male?) (USMN 000000), 18°16'21.81''N, 65°19'09.01''W, 3.2 km Southwest of Culebra Island, Puerto Rico, depth 28 m, collected between October 2002/2003. – Paratypes (same collection data as for holotype): one subadult (USMN 000000); one subadult (GCRL 0000): Additional specimens from the type locality are in the collection of second author.

Diagnosis: As for genus.

Etymology. — Species is named in honor Mónica Alfaro Lozano in recognition for her support and encouragement of our studies on the Tanaidacea from Puerto Rican waters.

Type locality. — 18°16'21.81''N, 65°19'09.01''W, 3.2 km Southwest of Culebra Island, off eastern Puerto Rico, depth 28 m, soft substrata (sand).

Distribution. — Presently known only from the type locality.

Description. — Subadult

Body (Fig. 2A): Length 4.5 to 5 mm, about 4.8 times longer than wide.

Cephalothorax (Figs. 2A, H): Slightly more than 22% of body length. Carapace smooth, longer than wide, subquadrate in dorsal aspect, slightly longer than pereonites 4 and 5 combined, with three simple setae on distolateral margins. Rostrum triangular, apically subacute. Eye lobe distinct unarmed; eyes poorly developed, lacking distinct pigment, ommatidia (about 8) small poorly formed. Epistomal spine relatively small, directed anterior ventrally.

Pereon (Figs. 2A–C): Slightly less than 55% of body length, generally decreasing slightly in width posteriorly; first pereonite widest, subquadrate, with two or three small simple setae on anterolateral corners, posterolateral corners rounded; first, third and fifth pereonites 1, 3, 5 subequal in length; pereonites 2 and 6 slightly shorter than other pereonites with small spine on posterolateral corners; pereonite 2 with small simple setae on anterolateral corners and one small simple seta on posterolateral corners; third to fifth pereonites 3–5 with a row of several small simple setae on anterolateral corners; pereonite 4 longer than other pereonites; pereonite 5 slightly smaller than fourth; pereonite 6 trapezoidal, with several simple setae on mid-lateral margin.

Pleon (Figs. 2A, D–E): Compressed, slightly less than 15% of body length, combined length shorter than carapace length; pleonites 1–4 each decreasing slightly in width posteriorly, each pleonite about twice as wide as long, with few small simple setae laterally, each pleonites with lateral lobes, each lobe with five (3 long, 1 short, and 1 very small) simple setae on tip and one very small simple seta on mid-ventral margin (Fig. 2D); pleonite 5 wider than others pleonites, without lateral lobes, having small simple setae dorsally and five simple setae (1 long, 3 short, and 1 shortest) on distolateral margin (Fig. 2E).

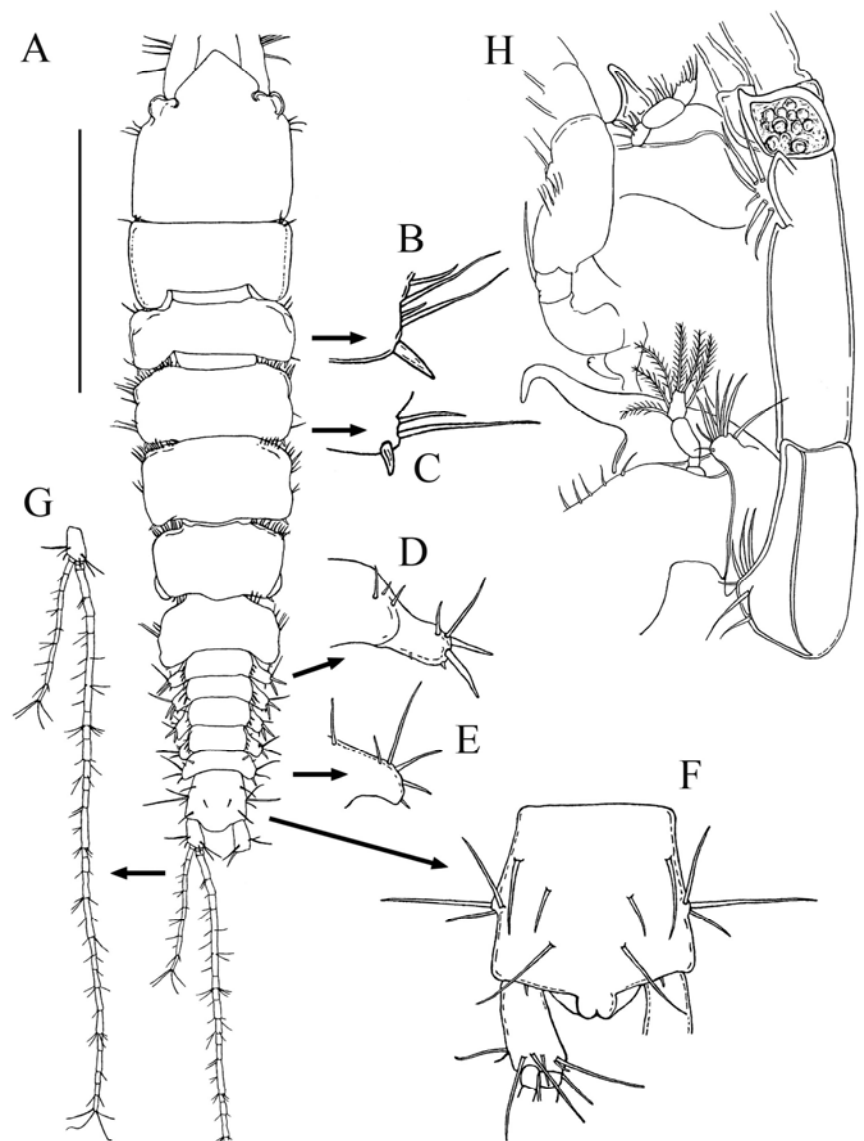


Figure 2. *Echinoparapseudes alfarvae* **n. gen., n. sp.**, subadult holotype. A, body, dorsal view; B, enlargement of posterolateral margin of pereonite 2; C, enlargement of posterolateral margin of pereonite 3; D, enlargement of lateral process of pleopod 1; E, enlargement of lateral view of pleopod 5; F, enlargement of pleotelson; G, enlargement of uropod; H, lateral view of cephalothorax and pereonite 1. Scale line: A = 1.0 mm; H = 0.2 mm

Pleotelson (Figs. 2A, F): About 8% of total length, subquadrate, about as long as wide, widest posteriorly just above lateral insertion of uropods, slightly longer than pereonite 3; pair of long, submarginal setae originating in anterior third; small protuberance on mid-lateral margin with cluster of three simple setae of varying length; pair of submedial simple

setae in med-region; pair of long, submedian, simple setae in posterior 1/3, reaching well-past posterior margin of pleotelson.

Antennule (Fig. 3A): Peduncle with four articles; article 1 about 3.3 longer than wide, with three broom setae along lateral and inner margins, and numerous simple setae on both margins; article 2 short, lacking setae; article 3 slightly longer than 2.5 first, brush seta on outer distal and near mid margins; article 4 about half length of third, with simple setae distally on both margins. Accessory flagellum with seven articles. Main flagellum with 14 articles, distal margins of articles 6, 8, 10 and 12 each with single aesthetasc.

Antenna (Fig. 3B): Basal article with six simple setae on inner margin and simple seta on outer margin. Article 2 with simple seta on inner distal margin; article 3 with three broom setae (1 proximal on outer margin, and 2 distally on inner margin); article 4 about twice length of article 3 with four broom setae (1 distal on inner margin, and 3 on outer margin), and four simple setae two on middle and two on subdistal margin. Squama at junction of peduncle article 1, well-development, longer than peduncle articles 2 and 3 combined, bearing 15 long simple marginal setae. Flagellum with sixth articles bearing long simple setae.

Mouthparts. Mandibles (Figs. 4A–D): Left mandible, incisor process with tip having four teeth; *lacinia mobilis* tridentate; setiferous lobe with six bifurcate setae. *Molar process* thick and relative short, with grinding surface having stronger armament of denticles. Palp with 3 articles; first article shortest bearing six to seven simple setae; second article longest, about twice that of first, with six (5 setulose and 1 simple) setae on distal margin; third article same length of first article, but slightly more slender than first, with five to seven setulate setae on distal margin, and three long simple setae and two short plumose setae distally (Fig. 4A). Right mandible, with; reduced bidentate *lacinia mobilis*; setiferous lobe with six bifurcate setae; incisor and molar process similar to that of left mandible.

Maxillule (Figs. 4E–F): Inner endite with five setulate setae, both margins finely setose. Outer endite with 12 spiniform setae (at least one being serrate) and two subdistal setulate setae, margins finely setose (setae longer on lateral margin); palp biarticulate with three subdistal and one distal whip-like “cleaning” setae (becoming longer distally).

Maxilla (Fig. 4G): Outer lobe of fixed endite with 2–3 pectinate trifurcate setae inner lobe of fixed endite with row of about 23–26 basally swollen setae; outer lobe of movable

endite with 5–7 simple setae and 2 long setulose setae on distal outer margin; inner lobe of movable endite with 11–14 simple setae.

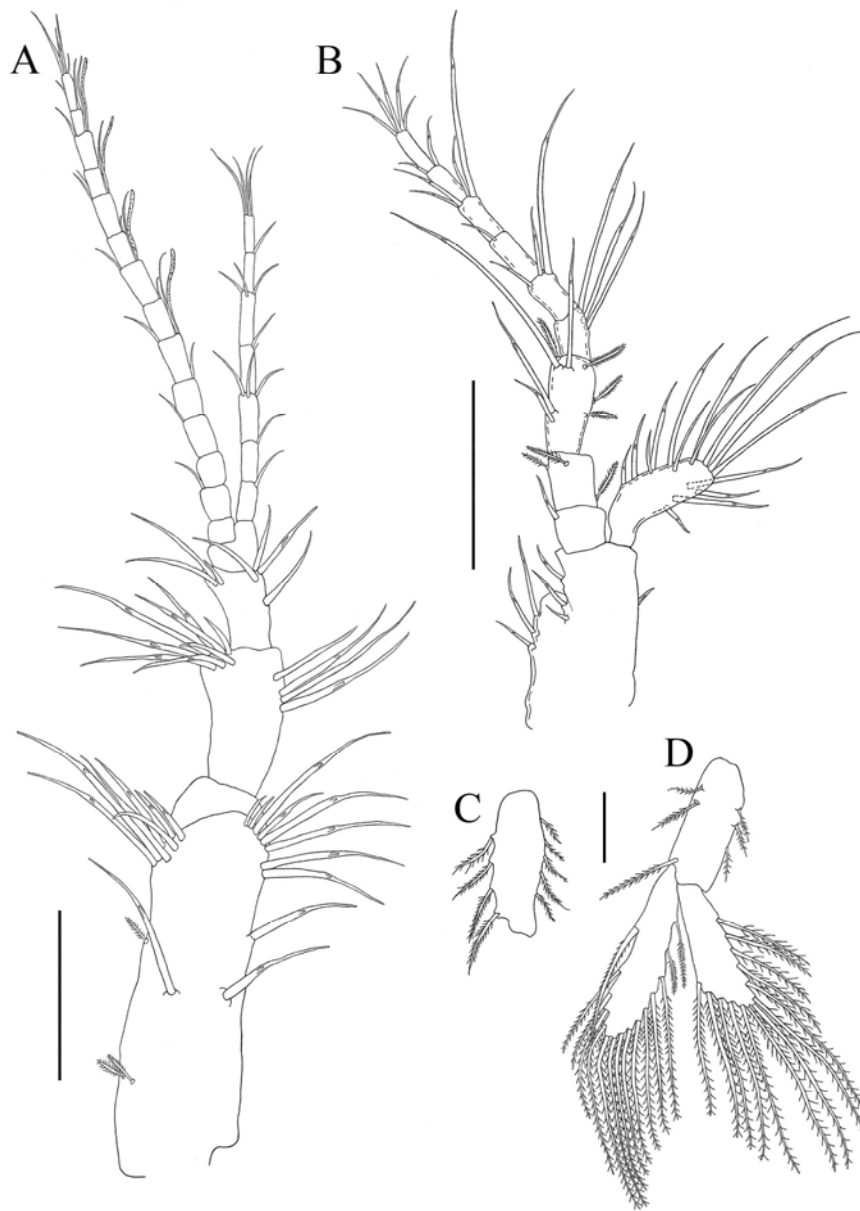


Figure 3. *Echinoparapseudes alfarvae* **n. gen., n. sp.**, subadult holotype. A, antennule; B, antenna; C, basal article of pleopod 1; D, pleopod 5. Scale line: A–B = 0.2 mm; C–D = 0.1 mm

Labium (Fig. 4H): with outer margin serrate, inner margin setulose. Palp with row of fine lateral setules and three spiniform distal setae.

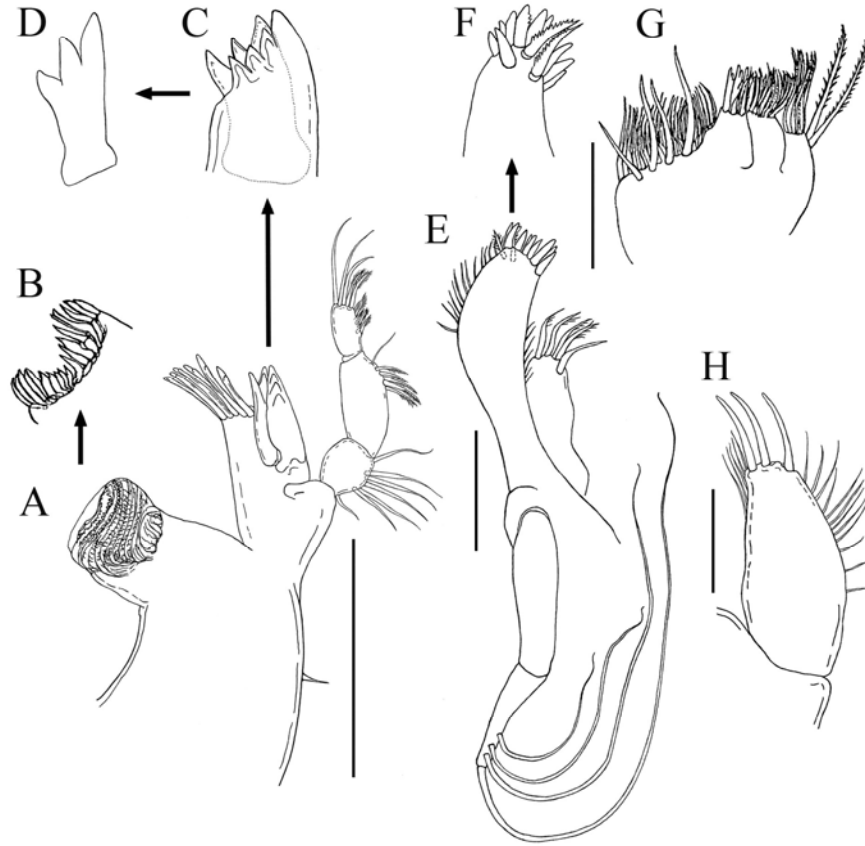


Figure 4. *Echinoparapseudes alfarvae* n. gen., n. sp., subadult paratype. A, left mandible; B, enlargement of tip of molar process; C, enlargement of *lacinia mobilis* and tip of incisor process; D, enlargement of tridentate *lacinia mobilis*; E, maxillule; F, enlargement of tip of maxillule; G, maxilla, H, labium. Scale line: A, E and H = 0.2 mm; G = 0.1 mm

Maxilliped (Figs. 5A–B): Basis, slightly longer than broad, outer face with small short simple seta near inner distal margin, distolateral margin smooth (Fig. 5A). Endite (inner plate) with 11–13 basally swollen setulate setae along margin of inner (anterior) face and with three coupling hooks on posterior inner margin (Fig. 5B); distal margin with row apically bidentate or grooved spiniform setae, inner most short distinctly bidentate becoming longer and distally bent and grooved laterally (Fig. 5B). *Palp (outer face)*: Article 1 about 2/3 as long as wide, inner margin with long seta (slightly shorter than article 2); small short simple seta near distal inner margin; outer margin with stout spiniform seta, less than half length of article 2 (Fig. 5A). Article 2 slightly longer than broad, inner margin with row 14–16 small to medium size setae along distal 2/3 of article, three long attenuated

simple setae medially and three long attenuated setae distally near base of article 3; distal corner of lateral margin with strongly developed spiniform seta extending to mid region of article 4 (Fig. 5A); article 3 about twice as wide and long; inner and distal margins combined with 17–20 simple attenuated setae (Fig. 5A); outer margin asetose. Article 4 about as long as wide, slightly less than half width of, and inserted laterally in, article 3; distal margin having six simple attenuated setae becoming longer laterally.

Epignath (Fig. 5C): Suboval, cup-shape with single, short seta on inner distal margin and two small simple setae on inner mid-margin.

Cheliped (Figs. 5D–F): Basis moderately inflated distally, constricted proximally with 3–4 small setae anteroproximally near junction with coxa; anterior margin slightly concave; posterior margin convex, rounded with stout spiniform seta, and four (2 long and 2 short) distal setae near posterodistal margin. Merus with length about three times width, having cluster of three simple subdistal setae anterolateral face near proximal junction with carpus; two long simple setae medially on or near posterior margin, and posterodistal margin with cluster of 7–8 simple setae of varying lengths. Carpus elongate, narrow (about 5 times longer than wide), inserted anterodistally into merus; midposterior margin with four simple setae (one long, reaching to junction with propodus), posterodistal margin with cluster of three simple setae, one distinctively long (reaching to middle of fixed finger), two pairs of simple setae on, or near, anterior and posterior distal margins. Propodus; anterodistal margin with three attenuated simple setae on anterodistal margin of palm adjacent at articulation with base of movable finger, posterior margin of fixed finger with row of 8–10 simple seta (2 distal most short curved distally); lateral aspect (Fig. 5E): outer face of palm near junction of fixed and movable finger with small sub-marginal simple seta near upper base of fixed finger; fixed finger with semicircular row of 15–18 sub-marginal setae; propodus inner aspect (Fig. 5F): four sub-marginal setae (3 simple and 1 small and setulate) medially at junction with movable finger, base of fixed finger near cutting edge with three simple setae, seta medially in distal third; unguis horn-colored. Dactylus (movable finger) slightly less than half length of palm; with three simple setae just proximal to unguis; unguis small, horn-colored, with bidentate tip. Exopod with three articles, third article bearing four plumose setae.

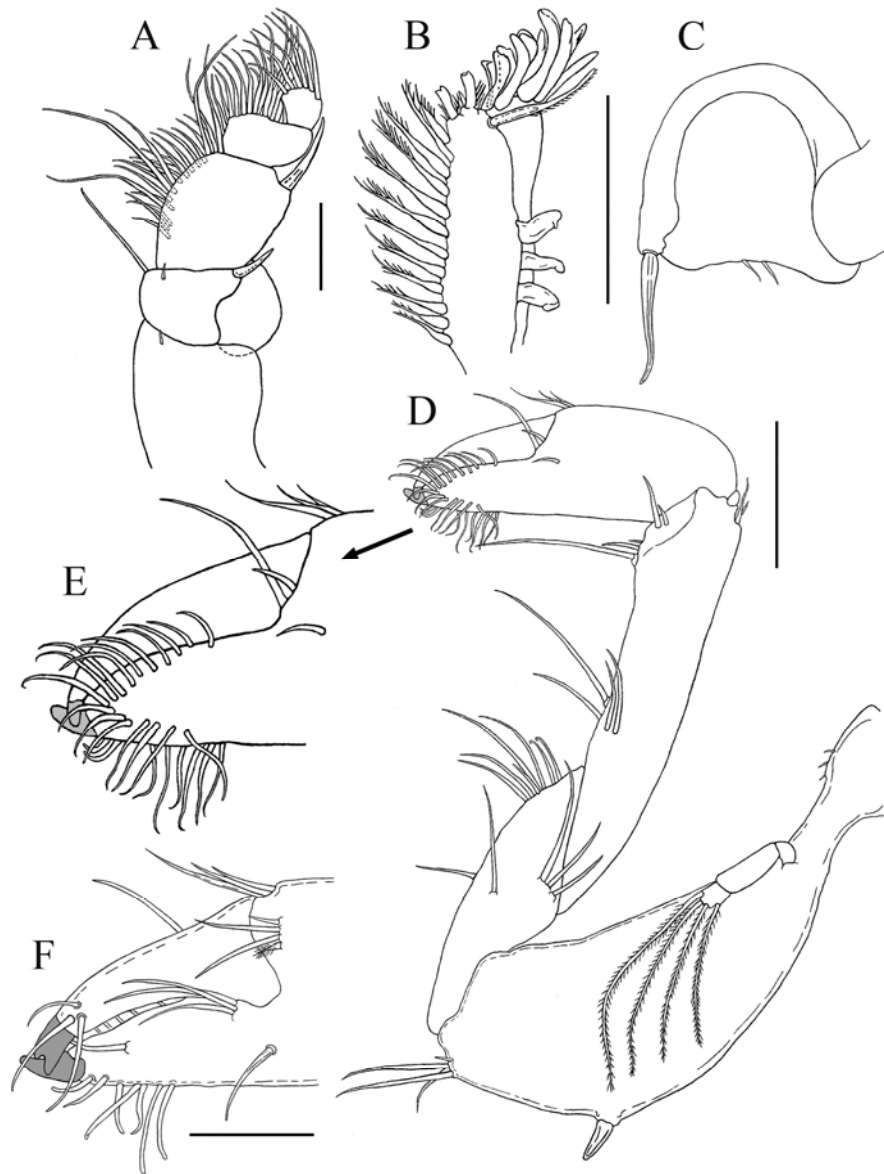


Figure 5. *Echinoparapseudes alfaroe* **n. gen., n. sp.**, subadult paratype. A, maxilliped showing setation; B, inner plate; C, epignath; D, left chela, lateral view, E, enlargement of tip of half chela, F, inner aspect of half chela. Scale line: A–D and F = 0.2 mm

Pereopod 1 (Figs. 6A–B): Coxal process present, but reduced to rounded protuberance (not seen from dorsal aspect), with 5–8 simple setae on anterodistal margin and small bilobed process on posterodistal margin. Basis slightly more than 1.5 times longer than

wide; anterior margin with proximal 2/3 having row of six simple setae with proximal most smallest, and strongly-developed, spiniform seta (just distal to row of simple setae); posterior margin with three stout spiniform setae, and cluster three long simple setae on distal margin immediately adjacent to distal most spiniform seta). Ischium compressed, much wider than long, with three simple setae (1 short and 2 long) on posterodistal margin. Merus slightly more than half its length and subequal to combined length of carpus and propodus; anterior margin with simple seta subdistally and strong spiniform seta on distal margin; posterior margin with four simple setae near mid-margin, simple seta on subdistal margin, and stout, conical, spiniform seta distally. Carpus slightly longer than wide; anterior margin having stout spiniform seta and four simple setae; posterior margin with two stout conical spiniform setae (distal-most largest), and two simple setae. Propodus narrower and slightly shorter than carpus; anterior margin with broom seta on mid-margin and three simple setae (2 medial and 1 sub-distal), and two (1 subdistal and 1 distally) stout conical spiniform setae becoming shorter proximally; posterior margin with four stout conical spiniform setae (becoming longer distally) and four simple setae, spiniform seta with fine outer setule distally. Dactylus slightly shorter than propodus; anterior with, two minute dorsal setae proximal to junction with unguis; posterior margin having four small ventral teeth. Exopod with three articles; article 1 very small, article 3 bearing six terminal or subterminal plumose setae.

Pereopod 2 (Fig. 6C): Basis less than three times width, anterior margin having well-development upturned spine on medial margin, plus 11–12 marginal or submarginal simple setae of varying length, most clustered proximally; posterior margin with proximal spiniform process armed with two small simple setae, mid-margin with two simple setae (larger about twice length of smaller), five simple setae (2 short and 3 long) on posterior distal margin. Ischium about twice as wide as long having anterior margin armed with spiniform seta. Merus about half length of carpus with posterior margin having one spiniform seta, distally, with six setae of varying length and one simple setae on subdistal lateral face; anterodistal margin with one spiniform setae and four (2 short and 2 long) simple setae. Carpus slightly longer than propodus; anterior distal and subdistal margin with cluster of 7–8 simple distally attenuated setae and sub-marginal spiniform seta; posterodistal margin with four simple setae,

sub-marginal spiniform seta on medial face. Propodus subequal in length and narrower than carpus; anterior margin large broom setae in mid-region, distal $\frac{1}{2}$ of margin with 7–9 simple distally attenuated setae of varying length and, with two (1 medial and 1 subdistal) short spiniform setae and long spiniform setae (about $\frac{4}{5}$ length of dactylus); posterior margin with three subequal spiniform setae and six simple setae. Dactylus about half length of propodus with weakly dentate distoventral margin, and two minute setae on anterior (or extender) margin.

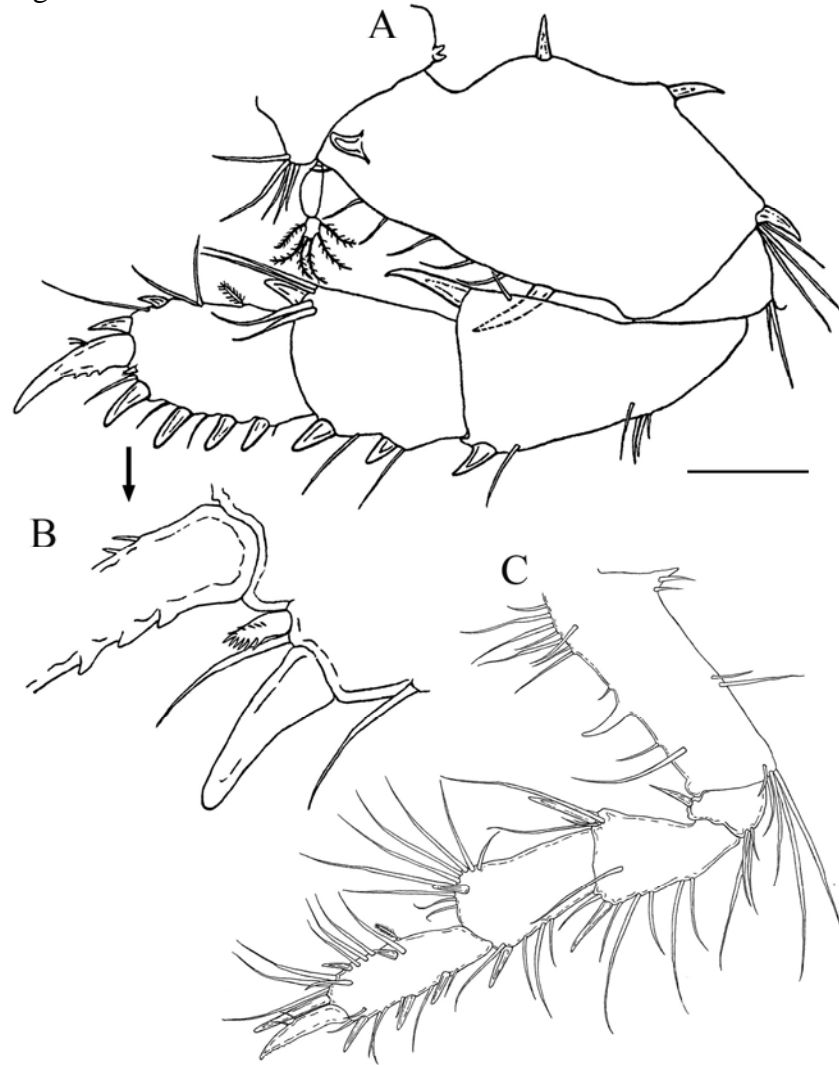


Figure 6. *Echinoparapseudes alfaroe* **n. gen., n. sp.**, subadult paratype. A, pereopod 1, lateral view; B, enlargement of tip of propodus; C, pereopod 2, lateral view. Scale line: A–C = 0.2 mm

Pereopod 3 (Fig. 7A): Basis with length slightly less than 2.5 times width; anterior margin asetose; posterior margin or submargin with four simple setae of variable length,

distal cluster of four attenuated setae (longest over $\frac{3}{4}$ length of basis); cluster of four long attenuated setae on proximal and distal third of outer face. Ischium about wider than long, anterodistal margin with spiniform seta; posterior margin having four (1 small and 3 long) simple setae, distally. Merus about 1.7 times longer than wide; posterior margin having four simple setae (2 long) and large spiniform seta; subdistal lateral face with small stout spiniform seta and long simple seta (about length of carpus). Carpus subequal length to merus; anterodistal margin with large spiniform seta and three (1 short and 2 long) simple setae; outer face with three simple setae and spiniform seta sub-distally; posterior margin with three simple setae (1 long, 2 short) and large spiniform seta. Propodus, length little over twice width, slightly longer and narrower than carpus; anterior margin having broom seta near mid margin, three attenuated simple setae, and three spiniform setae (increasing in length distally); outer face with medial small spiniform and simple seta and subdistal small simple seta, posterior margin with three spiniform setae and four simple setae (distal most, adjacent to dactylus, very small). Dactylus narrow about as long as propodus, two small on anterior margin setae; unguis simple, unguis about $\frac{1}{3}$ total length of dactylus.

Pereopod 4 (Fig. 7B): Basis with length slightly less than 2.5 times width; anterior region with three small broom setae (1 proximal and 2 medial), and seven to eight generally anteriorly submarginal (or submedial), usually anteriorly directed, simple setae (3 distinctively long and 4–5 small, simple setae on lateral face; posterior margin with small, simple seta subdistally and posterodistal cluster of three setae of varying length (longest extending to distal region of carpus). Ischium about 1.2 times wider than long, anterior margin with one spiniform seta; posterodistal margin with three distal setae of varying length (longest longer than merus. Merus slightly longer than wide anterior margin short lacking setae; posterior margin with medially with spiniform seta and five marginal and submarginal simple setae of varying length; anterodistal margin with long simple seta and two spiniform setae; distomedial margin with strongly developed attenuated seta reaching over $\frac{2}{3}$ length of carpus. Carpus slightly longer than wide; anterodistal margin with three attenuated setae (2 over $\frac{3}{4}$ length of propodus), remaining anterior margin asetose; posterior margin with four rod-like setae (becoming larger distally) and three attenuate setae; distal half of outer face with three spiniform setae (becoming longer distally) and three simple setae of varying length, small sub-marginal simple seta near mid-point of posterior margin.

Propodus with length about 3 times width, slightly shorter and narrower than carpus; anterior margin with broom seta; inner face with one, sub-marginal (more proximal) simple attenuated seta, two simple setae (1 short and stout) and two subdistal rod-like setae; posterior margin with two attenuated simple setae, long proximal rod-like seta and short spiniform seta distally near base of dactylus; distal margin with three long rod-like setae; distal margin with three long rod-like setae (nearly as long as dactylus and each with distal sensory setule) and cluster short pectinate setae. Dactylus subequal to length of anterior margin of propodus with two small dorsal setae; unguis, simple, small (about 1/5 total length of dactylus).

Pereopod 5 (Fig. 7C): Basis about 3 times longer than wide. Two short broom setae on anteroproximal margin; cluster of seven to eight simple setae of varying of length on proximal anterolateral face; anterior margin with 3 marginal simple setae and two (1 long & 1 short) submarginal simple setae in distal third; posterior margin with two small setae (proximal most minute) and anterodistal margin having four simple setae of varying length (longest reaching carpus). Ischium with length about twice width; anterior margin with two (1 short & and 1 long) spiniform setae; posterodistal margin with one short and two very long (longest reaching propodus). Merus about 2.5 longer than wide; anterior margin with spiniform seta on distal margin; distal half of posterior with cluster of seven or eight simple setae of varying of length (longest 3 equal to or greater than length of carpus), large spiniform seta on distolateral margin and smaller spiniform seta subdistal margin. Carpus slightly longer than wide; anterior margin asetose, cluster of five simple setae of varying lengths (longest extending to base of dactylus) present on inner distal face; inner face with two simple and three rod-like spiniform setae, increasing in size distally; posterior margin with five simple and four rod-like spiniform setae, increasing in size distally. Propodus slightly more than 3.5 times wide, about as long as and narrower than carpus; anterior margin with large broom seta medially; one medial and five subdistal or distal rod-like spiniform setae of varying lengths and one medial and three submarginal simple attenuated setae present; posterior margin with three rod-like spiniform setae (becoming larger distally) and two simple attenuated setae. Dactylus slightly shorter than propodus with two minute setae on anterior margin proximal to junction with unguis; unguis simple, slightly less than third total length of dactylus.

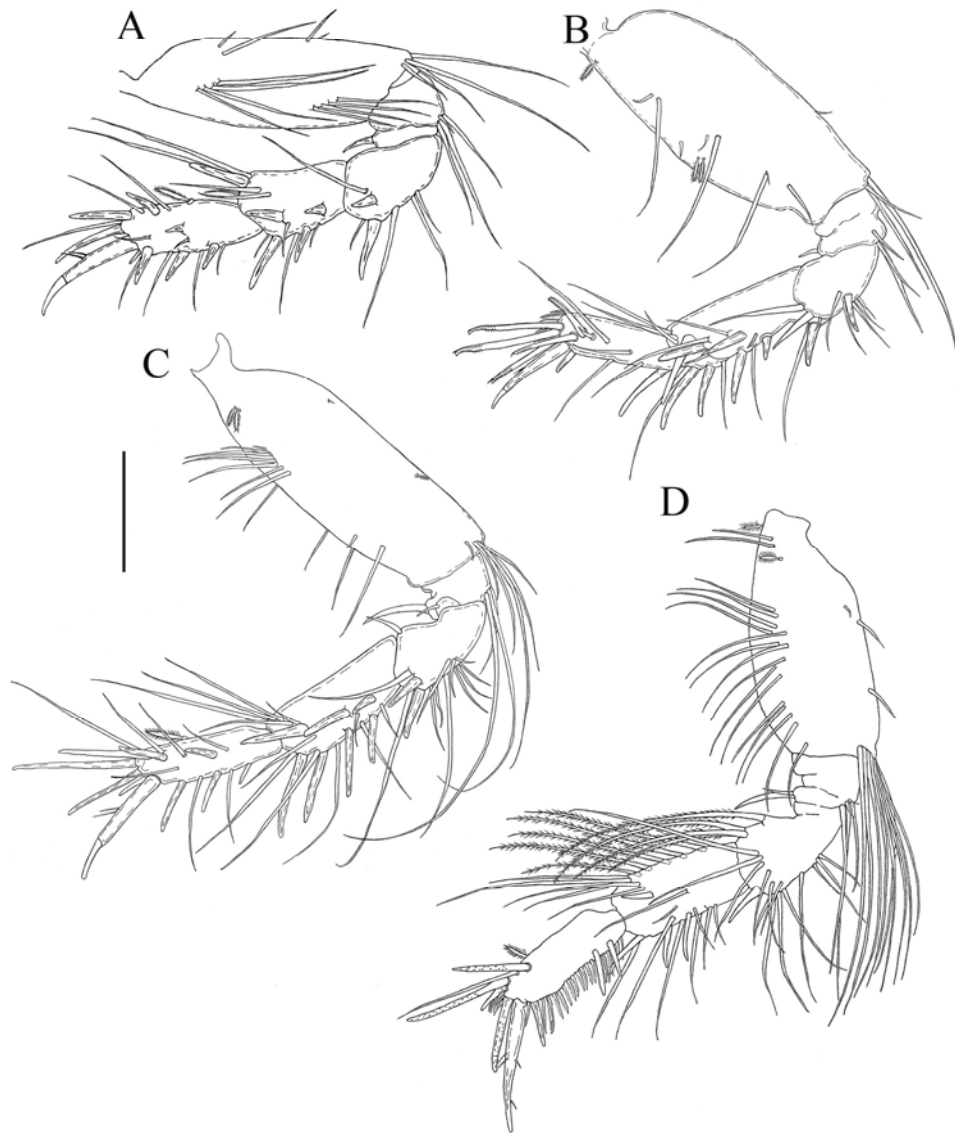


Figure 7. *Echinoparapseudes alfaroae* **n. gen., n. sp.**, subadult holotype. A, pereopod 3, lateral view; B, pereopod 4, lateral view; C, pereopod 5, lateral view; D, pereopod 6, lateral view. Scale line: A–D = 0.2 mm

Pereopod 6 (Fig. 7D): Basis swollen, about twice as long as wide, with two short broom setae and two simple setae proximally, 14–16 long simple length on lateral face of adjacent to anterior margin, posterior margin with three (1 small) simple setae (1 small) near to medial margin and 8–10 long simple setae (some extending distally to mid-region of carpus) on distal margin. Ischium about as long as wide, anterior margin with two (1 short and 1 long) spiniform setae; posterodistal margin with five simple setae of varying length (longest extending distally to carpus). Merus proximally attenuated, slightly longer than

wide; anterior margin three long setulate setae extending near or beyond junction of carpus and propodus; posterior margin with six to seven attenuated simple setae of varying length and one spiniform seta distally; inner face with six to seven attenuated simple setae of varying of length subdistally. Carpus about twice as long as wide, anterior margin with five long setulate setae; oblique subdistal row of six simple attenuated setae originating at anterior margin (becoming shorter posteriorly) and ending medially adjacent to spiniform seta; one long attenuated simple seta medially, extending proximally to propodus; eight to nine simple attenuated setae of varying lengths and three narrow spiniform setae occurring on or adjacent to posterior margin. Propodus with length three times width, slightly shorter and narrower than carpus; anterodistal margin with brush seta, three subterminal rod-like spiniform setae (2 long, 1 short), long attenuated seta, and terminal rod-like spiniform seta (slightly more than half length of dactylus); posterior margin with two elongate spiniform setae and compact row of about 18-20 small, pectinate setae. Dactylus slightly shorter than propodus with three minute setae proximal to junction with unguis (2 on anterior margin and 1 on posterior margin); unguis about third total length of dactylus, with one minute setae on midposterior margin.

Pleopods (Figs. 3C–D): Biramous well-developed, becoming only slightly smaller posteriorly. Pleopod 1: basal article sub endopod, 4–5 setulate setae on inner and lateral margins (Fig. 3C); exopod with 11–13 plumose plus two small setulate setae on inner proximal margin; endopod shorter than exopod (about equal in length with basal article), having 12–14 plumose setae on inner, distal and distal half of lateral margins. Pleopods 2–5 with basal article becoming less setose posteriorly (Fig. 3D).

Uropod (Figs. 2A, F–G): Basal article about 1.7 times as long as wide, with two (1 short and 1 long) simple setae on subdistal outer margin, posterior margin having three simple setae of varying of length on subdistal margin, with two (1 short and 1 long) simple setae on subdistal inner margin. Exopod with 8–9 articles, distal-most article having four apical simple setae. Endopod with division of articles or pseudoarticles unclear, apparently numbering from 27–33, distal-most article with four simple apical setae.

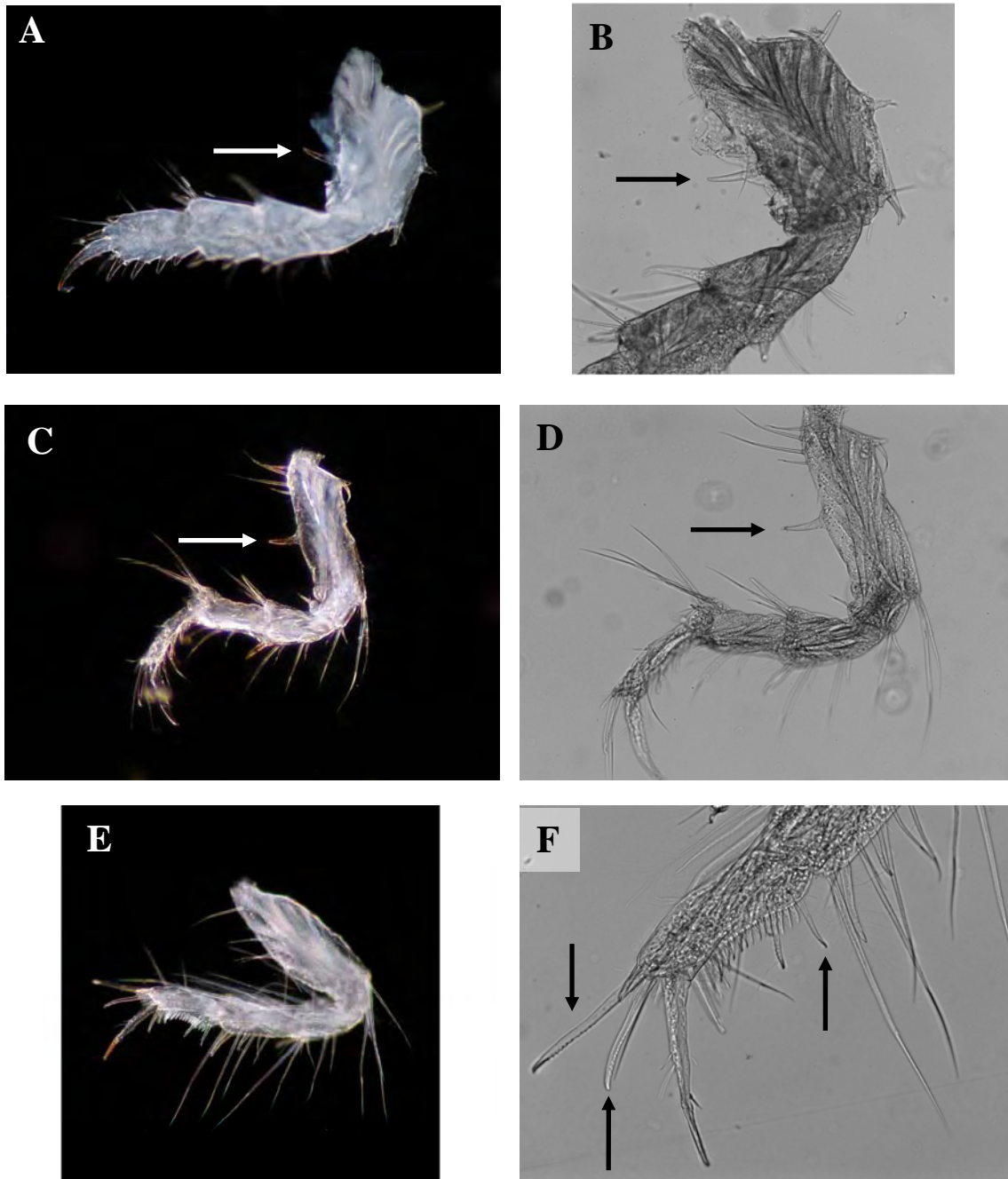


Figure 8. Pictures showing: A and B, pereopod 1, arrows shown strongly developed spiniform setae on frontal margin basis; C and D, pereopod 2, arrows shown spine on frontal margin of basis; E, pereopod 6; F, tip of propodus and dactylus of pereopod 6, arrow shown distinctive rod-like spiniform setae.

Adult Female and adult Male not recognized.

Remarks. As mentioned in the *Remarks* for the genus, *Echinoparapseudes alfaroe*, **n. gen., n. sp.**, may be congeneric or at least closely related to “Parapseudid ? sp. A” *sensu* Heard et al. (2004) reported from the Gulf of Mexico, but it can be readily distinguished from this as yet described species by the armature of the first and second pereopods. On *E. alfaroe*, the first pereopod has the anterior margin of the basis armed with a large distinctive spiniform seta and a single well-developed spiniform seta on the anterodistal margin of the carpus; whereas, on “Parapseudid? species A” the basis lacks a large spiniform seta on the anterior margin and the anterodistal margin of the carpus is armed with two large spiniform setae. Pending the descriptions of additional species attributable to this genus, the specific or generic importance of these pereopod characters remains to be determined.

There is the possibility that *E. alfaroe* may be a protandric hermaphrodite. The six specimens examined by us appeared to be subadults or possibly non-sexually dimorphic males. Their chelipeds appear typical of other parapseudid females, but there is no indication of developing oostegite buds. On the mid-ventral surface of the sixth pereonites of all the specimens we examined, however, an acutely tipped and posteriorly directed penes or a penes-like process, similar to that for the male of *Saltipedis puertoricensis* Morales-Núñez, Heard, & Alfaro, 2010, was present. Adult females of *S. puertoricensis*, however, were also observed to have a similar, but reduced hyposphenia or vestigial penes-like process (Morales-Núñez et al. 2010).

Ecological notes. Based on its morphology and the sand substrata (i.e. fine and medium sand, indicating coralline origin from fragments of algae, shells, and coral) in which it occurs, *E. alfaroe* appears to be a fossorial, shallow burrowing, species. It co-occurred with a variety of infaunal and epifaunal invertebrates, including at least 14 other species of Tanaidacea (A.G. Morales-Núñez and R. Heard, pers. obser.). These include the recently described apseudomorphan, *Saltipedis* (*Spinosaltipedis*) *puertoricensis*, and undescribed tanaidomorphans belonging to the genera *Paratanais* Dana, 1852; *Pseudoleptochelia* Lang, 1973; and *Pseudonotanaeis* Lang, 1973.

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CHAPTER IV

A new species of *Mesokalliapseudes* Lang, 1956 (Crustacea: Tanaidacea: Kalliapseudidae) from Puerto Rico, with remarks on the genus.

Drumm, D.T., and **Morales-Núñez, A.G.**, 2010. A new species of *Mesokalliapseudes* Lang, 1956 (Crustacea: Tanaidacea: Kalliapseudidae) from Puerto Rico, with remarks on the genus. *Zootaxa*, 2687: 45–55.



A new species of *Mesokalliapseudes* Lang, 1956 (Crustacea: Tanaidacea: Kalliapseudidae) from Puerto Rico, with remarks on the genus

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Abstract

A new kalliapseudid species, *Mesokalliapseudes quadriflagellata* n. sp. from Puerto Rico is described and illustrated. It can be distinguished from its congeners by the following combination of characteristics: 1) rounded rostrum, 2) pereonites lacking anterolateral apophyses, 3) fixed finger of cheliped two-thirds or more the length of the dactylus, and 4) serrate spiniform seta on the basis of pereopod 1. It is unique in having the inner flagellum of the antennule with 4 articles (all other congeners have 3 articles). Remarks on the genus *Mesokalliapseudes* are presented.

Key words: Crustacea, Tanaidacea, Kalliapseudidae, *Mesokalliapseudes*, Puerto Rico

Introduction

Mesokalliapseudes was originally a subgenus of *Kalliapseudes* Lang, 1956, created to receive the type species, *Kalliapseudes crassus* Menzies, 1953 from the Pacific coast of Mexico, characterized by the dactylus of pereopods 2 and 3 with well-developed sensorial setae, and the lack of an exopodite on the cheliped and pereopod 1. Guțu (2006) elevated the subgenera of *Kalliapseudes* to full generic rank. The genus currently comprises seven species, two in the northeastern Pacific and five in the western Atlantic. Two kalliapseudid species are currently known to occur in Puerto Rican waters: *Psammokalliapseudes granulosus* Brum, 1973 and *Tanapseudes gutui* Hansknecht *et al.*, 2002 (both in the subfamily Tanapseudinae) (Drumm and Heard, 2010).

Examination of Tanaidacea collected from the near-shore waters of Puerto Rico revealed a new species in the genus *Mesokalliapseudes*. In this paper we describe this new species and present remarks on the genus *Mesokalliapseudes*.

Material and methods

The specimens used in this study were collected from five localities in the southwestern region of La Parguera, Puerto Rico during June and August 2008, and October 2009. Sampling locations were East Media Luna, Isla de los Pájaros, North El Palo and Margarita keys in La Parguera Natural Reserve, and El Peñón (Figure 1). Sediment samples from sandy bottoms of La Parguera keys were collected using a van Veen grab (0.25 m²) and samples from El Peñón were collected using PVC corer samplers (8.8 cm diameter, 10 cm, length, 62 cm² area). Samples were filtered through a stainless-steel sieve with a 0.5 mm mesh size and preserved in 4% formalin with Rose Bengal stain. In the laboratory fixed and dyed specimens were hand-sorted from each sediment sample, and preserved in 70% ethanol. Body length was measured from the tip of

the rostrum to the posterior end of the pleotelson. Material has been deposited in the National Museum of Natural History, Smithsonian Institution, Washington, D.C. (USNM).

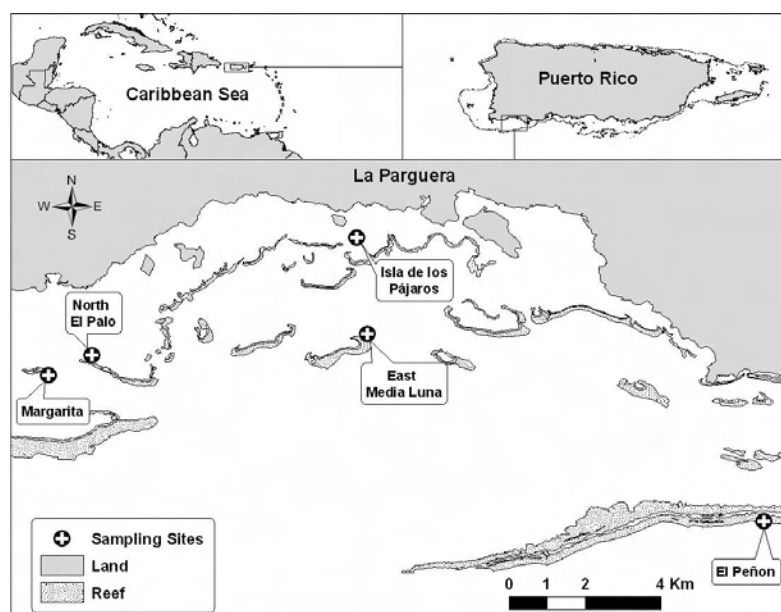


FIGURE 1. Map of Puerto Rico showing the collecting localities for *M. quadriflagellata* n. sp.

Order Tanaidacea Dana, 1849

Suborder Apseudomorpha Sieg, 1980

Superfamily Apseudoidea Leach, 1814

Family Kalliapseudidae Lang, 1956

Subfamily Kalliapseudinae Lang, 1956

Genus *Mesokalliapseudes* Lang, 1956

Mesokalliapseudes quadriflagellata n. sp. (Figs. 2–6)

Material examined. Holotype: adult female with oostegites (USNM 1148172), Puerto Rico, Southwest of La Parguera, Isla de los Pájaros, 17°57.557'N, 67°02.246'W, 0.8 m depth, coll. Oct. 17, 2009. Allotype: adult male (USNM 1148173), Puerto Rico, Southwest of La Parguera, Margarita, 17°55.337'N, 67°07.084'W, 16.8 m depth, coll. Feb. 2, 2010. Paratypes: 1 male, 1 juvenile, 1 manca (USNM 1148174), same locality data as holotype; 1 ovigerous female, 1 juvenile, 3 mancás (USNM 1148175), same locality data as allotype; 1 adult female with oostegites (partly dissected) (USNM 1148176), Puerto Rico, Southwest of La Parguera, North El Palo, 17°56.249'N, 67°06.192'W, 9.4 m depth, coll. Aug. 1, 2008; 1 juvenile (USNM 1148177), Puerto Rico, Southwest of La Parguera, El Peñón, 17°53.886'N, 66°56.607'W, 57 m depth, coll. Jun. 10, 2008; 3 juveniles (USNM 1148178), Puerto Rico, Southwest of La Parguera, Margarita, 17°55.964'N, 67°06.808'W, 14.9 m depth, coll. Aug. 1, 2008.

Diagnosis (adult). Rostrum rounded. Pereonites lacking anterolateral apophyses. Pleotelson broader than long. Inner flagellum of antennule with four articles; first peduncle article approximately 3.5 times as long as broad. Third article of antenna without distinctive spinulate process. Mandibular palp terminally with

plumose seta. Fixed finger of cheliped more than two-thirds length of dactylus. Pereopod 1 basis with serrate spiniform seta. Pereopod 6 propodus with four outer serrate spiniform setae; dactylus with one subterminal seta. Last article of uropod exopodite approximately 1.5 times as long as second article. Hyposphenia absent.

Etymology. *Quadra* (Lat.) + *flagellatus* (Lat.). Named after the 4-articulate inner flagellum of the antennule.

Description of adult female with oostegites. Body length (Fig. 2A) approximately 5 mm, 5.8 times as long as broad.

Carapace (Fig. 2A) as broad as long, one pair each of mid-lateral and dorsal setae; rostrum rounded.

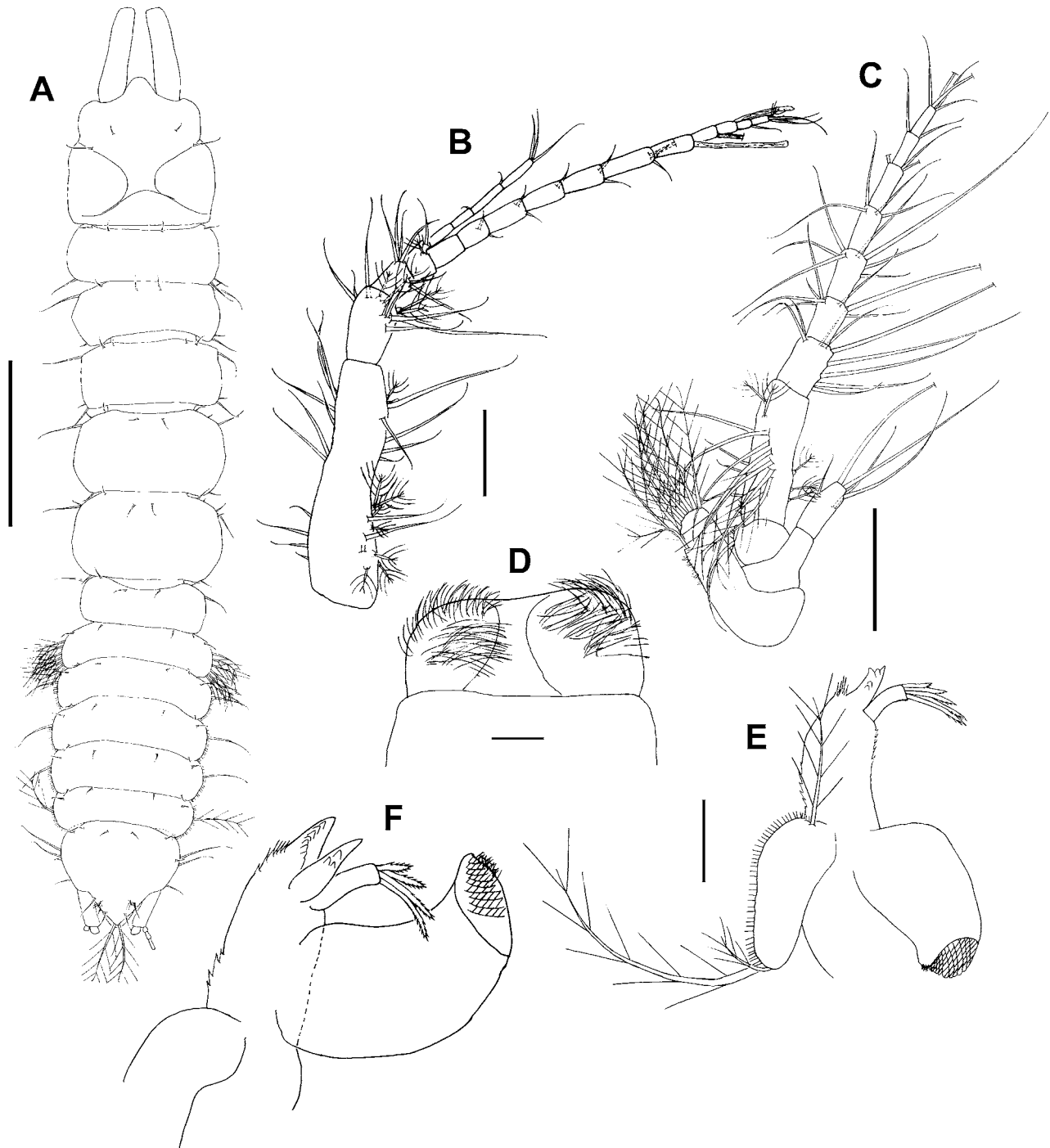


FIGURE 2. *Mesokalliapseudes quadriflagellata* n. sp., female with oostegites. A, dorsal view of body; B, antennule; C, antenna; D, labrum; E, right mandible; F, left mandible. Scale bars: A = 1.0 mm; B, C = 0.2 mm; D = 0.05 mm; E = 0.1 mm.

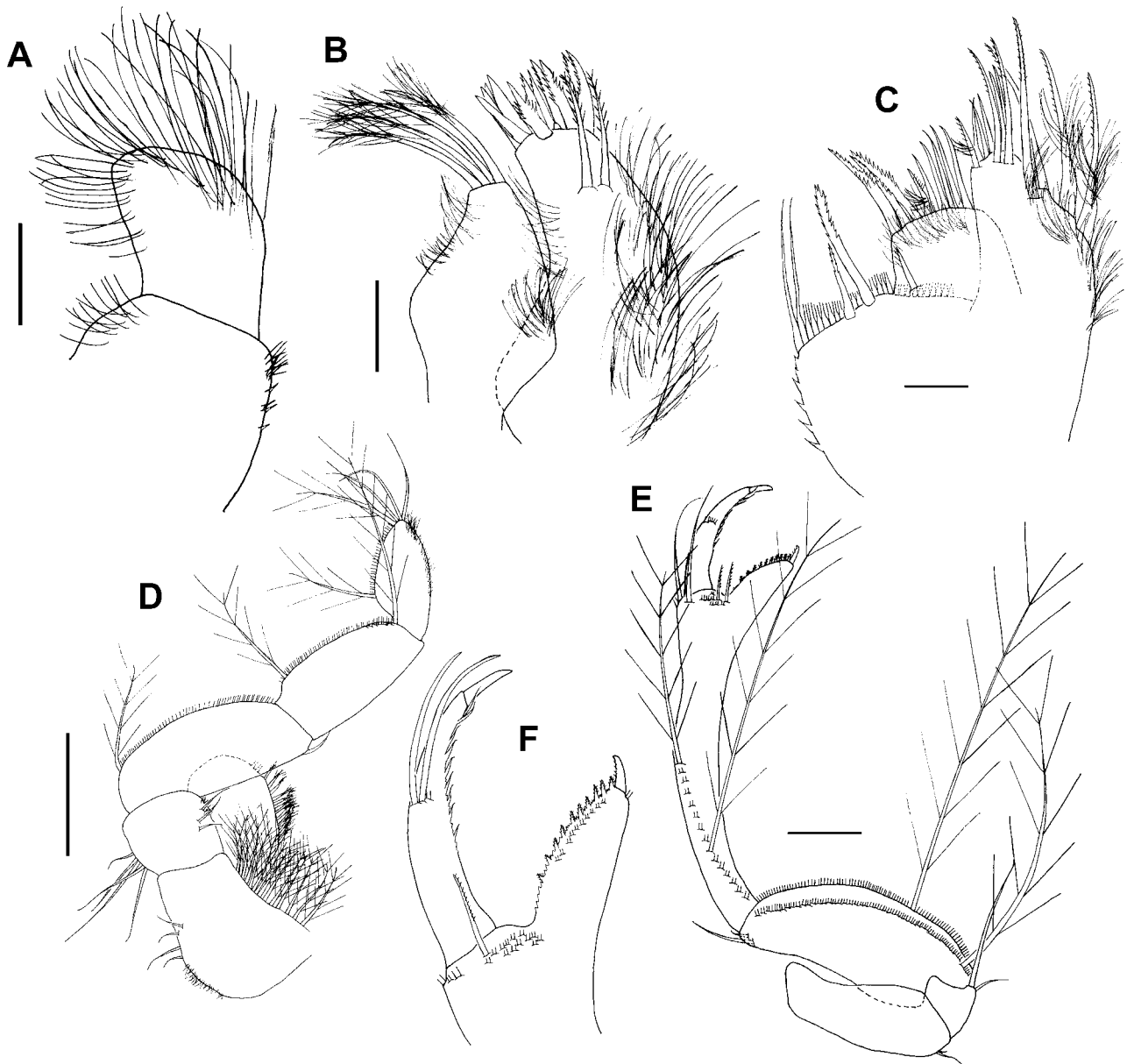


FIGURE 3. *Mesokalliapseudes quadriflagellata* n. sp., female with oostegites. A, labium; B, maxillule; C, maxilla; D, maxilliped; E, cheliped (inner view); F, chela (inner view). Scale bars: A–C = 0.05 mm; D, E = 0.2 mm.

Pereonites (Fig. 2A). Pereonites 4 and 5 longest and subequal in length, pereonites 1 and 2 subequal in length and shorter than pereonite 3, pereonite 6 shortest, all rounded laterally; one to several simple setae on anterior corners, one or two simple setae on posterior corners, and at least one pair of dorsal simple setae; hyposphenia absent.

Pleonites (Fig. 2A) subequal in length; epimera rounded, with several plumose setae and two pairs of short simple dorsal setae and one longer pair of lateral simple setae; hyposphenia absent. Pleotelson (Fig. 2A) tapering posteriorly to rounded tip, with several lateral and dorsal simple setae; two long terminal plumose setae.

Antennule (Fig. 2B). First peduncle article approximately 3.5 times as long as broad, with several simple and broom setae on outer margin and several simple setae on inner margin. Second peduncle article with several distal simple and broom setae. Third peduncle article with several distal simple setae. Fourth peduncle article with one simple and one broom setae. Inner flagellum with four articles, distal article with three simple setae; outer flagellum with 11 articles, nearly as long as peduncle, one aesthetasc each on articles 6, 7, 8 and 9, and three simple and one broom setae on distal article.

Antenna (Fig. 2C). First article with medial extension bearing eight plumose setae. Squama with five simple setae. Third article short and rounded, with few spinules on inner margin. Fourth peduncle article shorter than first three flagellum articles together, with three proximal plumose and three distal simple setae on ventral surface, three broom setae on outer margin and two distal broom setae, and four simple setae on inner margin. Flagellum with seven articles bearing long, simple setae; distal article with five simple setae.

Labrum (Fig. 2D) sub-rectangular bearing numerous hair-like setae.

Mandibles (Figs. 2E, F). Right mandible (Fig. 2E) with five-dentate incisor process and spine row with five spiniform setae. Left mandible (Fig. 2F) with approximately nine denticulations on incisor process; lacinia mobilis appearing to have four denticulations; spine row with four spiniform setae. Mandibular palp terminating in short plumose seta.

Labium (Fig. 3A). Distal margin provided with short hair-like setae and spinulate on outer margin. Palp with long hair-like setae.

Maxillule (Fig. 3B). Inner endite bearing four terminally setulate setae and dense row of hair-like setae on outer and inner margins. Outer endite with seven long serrate, four long naked and one short spiniform setae, two subterminal setae and dense row of hair-like setae on outer and inner margins.

Maxilla (Fig. 3C). Inner lobe of fixed endite with posterior row of two serrate spiniform setae and with long anterior row of filter setae. Outer lobe of fixed endite with three serrate setae, one plumodenticulate (bearing setules and denticles) and several simple setae distally and one short pectinate seta on posterior face. Inner lobe of moveable endite with one short plumodenticulate seta, two long serrate setae and several simple setae; outer lobe of moveable endite with two serrate and two plumodenticulate setae. Inner margin spinulate.

Maxilliped (Fig. 3D). Basal article fringed with plumose setae on outer margin, four simple setae on inner margin. First article of palp with five simple setae on inner margin and three simple setae near outer margin. Last three articles of palp with double row of long plumose setae on inner margin; second article with one distal simple seta on outer margin; last article terminating in three simple setae. Endite with several pappose setae along margin (distal setae broken off and thus not illustrated); two coupling hooks. Epignath not examined.

Cheliped (Figs. 3E, F). Basis with two simple ventrodistal setae. Merus with one long and one short simple setae. Carpus approximately 2.5 times as long as broad, with double row of long, plumose setae and two simple setae on dorsodistal corner. Propodus slender and very long, approximately 1.5 times as long as carpus, with diagonal row of long plumose setae on inner face; palm region with several long simple and serrate setae distally; fixed finger more than two-thirds length of dactylus, with several simple setae; cutting edge with 10 bipectinate spiniform setae interspersed with one to several spinules. Dactylus with three long setae on inner face (only the bases are shown on the whole cheliped illustration); cutting edge with nine spinules increasing in length distally, proximal ones interspersed with one or two short protuberances.

Pereopod 1 (Figs. 4A, B). Basis with acute, proximal process, several short simple setae on dorsal margin and two setae (one serrate and one simple) ventrodistally. Ischium short with two simple setae on ventrodistal corner. Merus approximately 2.8 times as long as broad, approximately 3.4 times as long as carpus, with several simple setae on ventral margin, one ventrodistal spiniform seta, and one short dorsodistal spiniform seta. Carpus short with two ventrodistal and one dorsodistal spiniform setae, outer surface with row of small tubercles. Propodus shorter than carpus, three ventral and two dorsodistal spiniform setae; outer surface with small tubercles, inner surface with two short distal pectinate setae. Dactylus represented by sensory organ with numerous distal sensory setae and inner surface with two setae (one long and one short).

Pereopod 2 (Fig. 4C). Basis approximately 3.5 times as long as broad, several short simple setae on dorsal margin, one simple and one spiniform ventrodistal setae. Ischium with two simple ventrodistal setae. Merus shorter than carpus, with two simple and one spiniform ventrodistal setae. Carpus approximately 1.7 times as long as broad, with seven short spiniform setae and two long dorsodistal setae. Propodus approximately one-half length of carpus, with six spiniform setae, one long simple seta and one long serrate spiniform setae dorsodistally, one broom seta midway on dorsal margin. Dactylus long and slender, shorter than basis, with thin outer digitiform lobe terminating in three sensory setae.

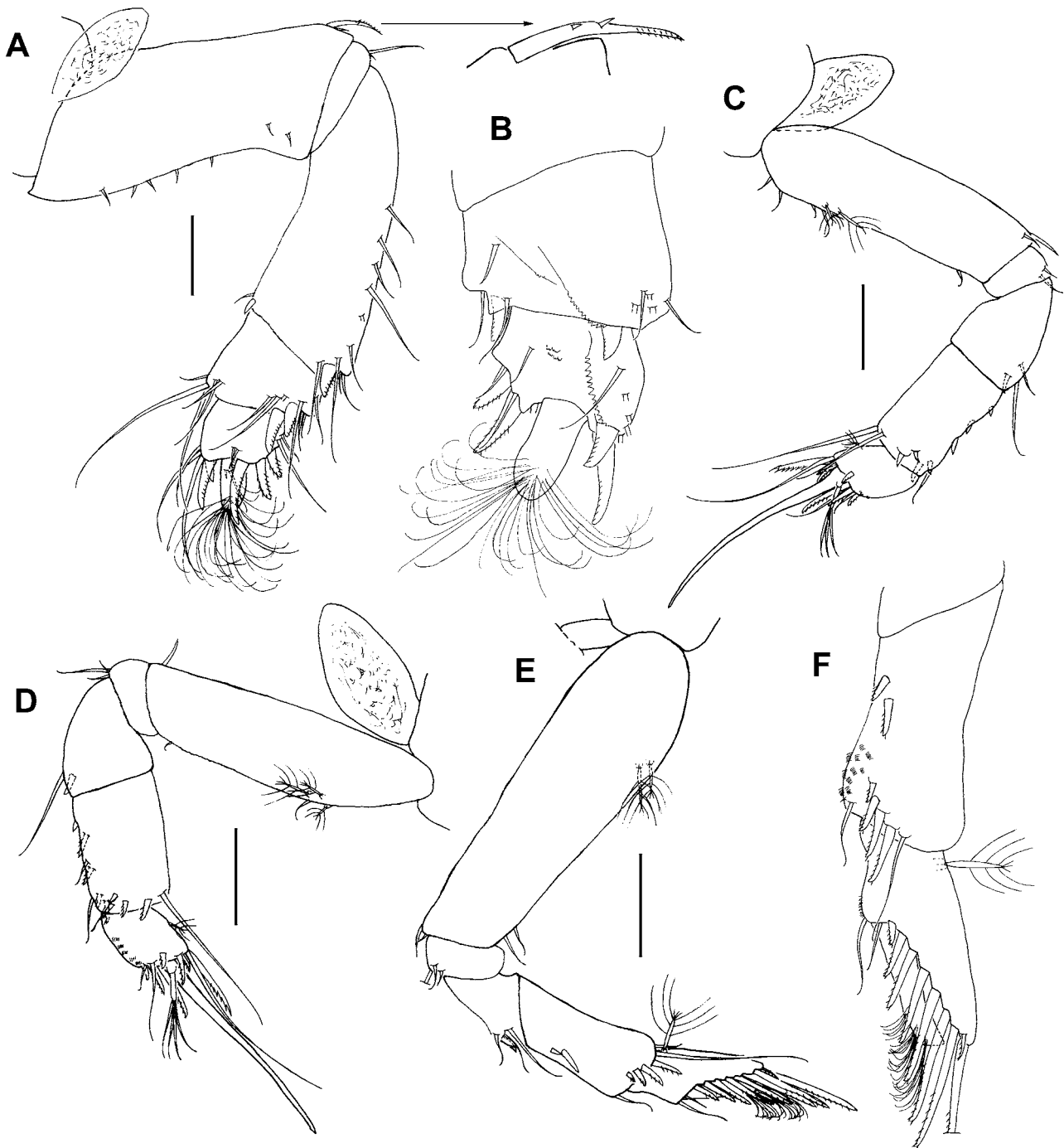


FIGURE 4. *Mesokalliapseudes quadriflagellata* n. sp., female with oostegites. A, pereopod 1 (inner view); B, carpus, propodus and dactylus of pereopod 1 (outer view); C, pereopod 2 (outer view); D, pereopod 3 (outer view); E, pereopod 4 (inner view); F, carpus, propodus and dactylus of pereopod 4 (outer view). Scale bars = 0.2 mm.

Pereopod 3 (Fig. 4D). Similar to pereopod 2. Carpus with eight spiniform setae. Proximal digitiform lobe of dactylus with four sensory setae.

Pereopod 4 (Figs. 4E, F). Basis approximately 3.5 times as long as broad with two simple setae on dorsal margin and ventrodistal corner, and two broom setae on proximal outer surface near dorsal margin. Ischium with three simple setae. Merus shorter than carpus with three simple and one spiniform setae ventrodistally. Carpus with six spiniform setae on inner surface and six spiniform setae on outer surface, one long simple dorsodistal seta. Propodus with eight spiniform setae on each side increasing in length distally, one short pectinate seta on inner and outer surfaces and one broom seta proximally on dorsal margin. Dactylus represented by sensory organ with numerous distal sensory setae.

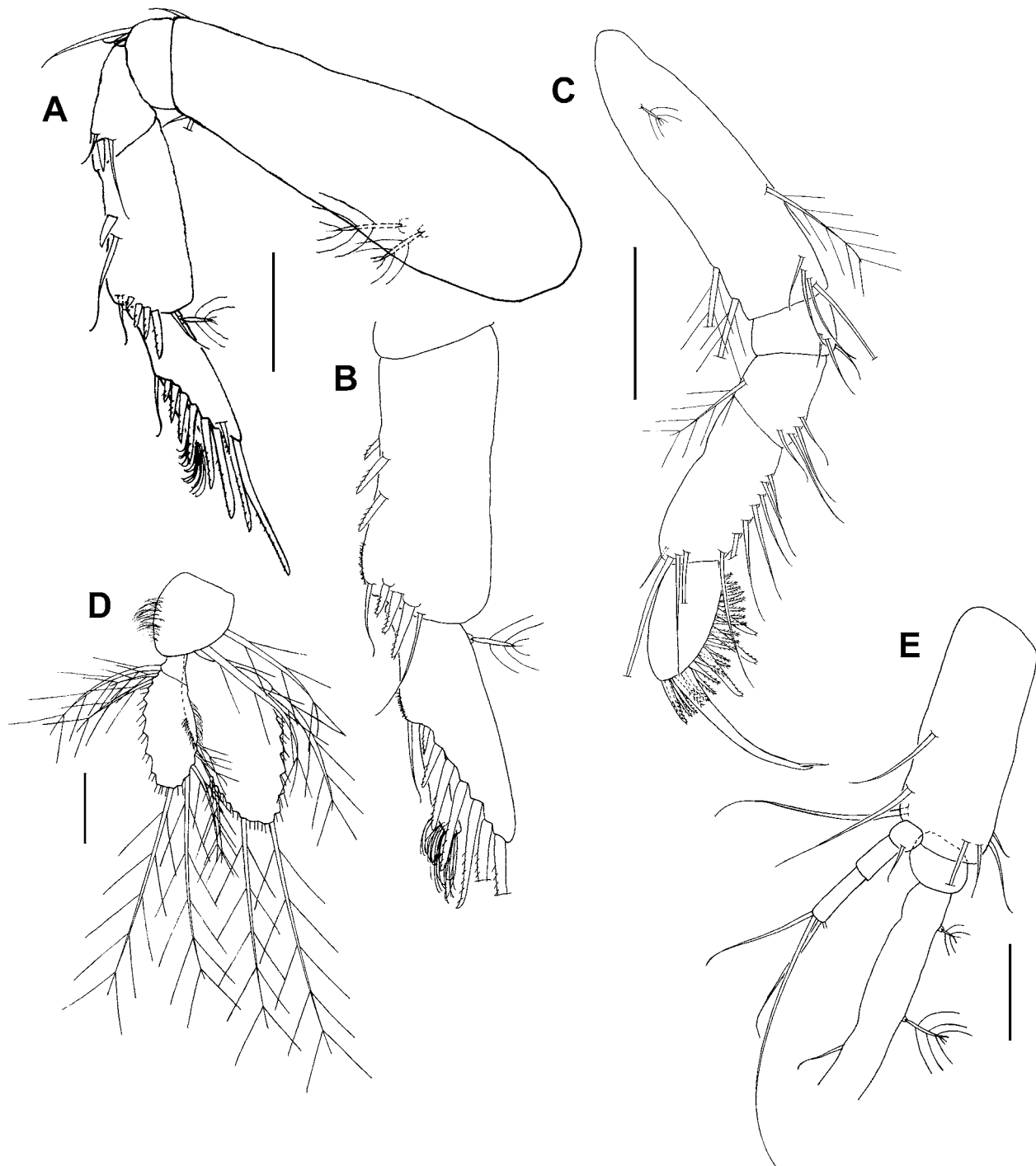


FIGURE 5. *Mesokalliapseudes quadriflagellata* n. sp., female with oostegites. A, pereopod 5 (inner view); B, carpus, propodus and dactylus of pereopod 5 (outer view); C, pereopod 6 (outer view); D, pleopod; E, uropod. Scale bars: A–D = 0.2 mm; E = 0.1 mm.

Pereopod 5 (Figs. 5A, B). Similar to pereopod 4. Carpus with five spiniform setae on inner surface. Propodus without pectinate seta on the outer surface.

Pereopod 6 (Fig. 5C). Basis with two long plumose setae on dorsal margin, one long plumose seta on ventral margin, four simple ventrodistal setae, and one proximal broom seta on outer surface. Ischium with three ventrodistal simple setae. Merus with four ventrodistal simple setae, and one plumose seta near dorsal margin. Carpus approximately two times as long as merus with seven simple setae near ventral margin and four distal simple setae. Propodus with four outer spiniform setae and approximately 21 inner bipectinate setae. Dactylus longer than propodus with one subterminal seta.

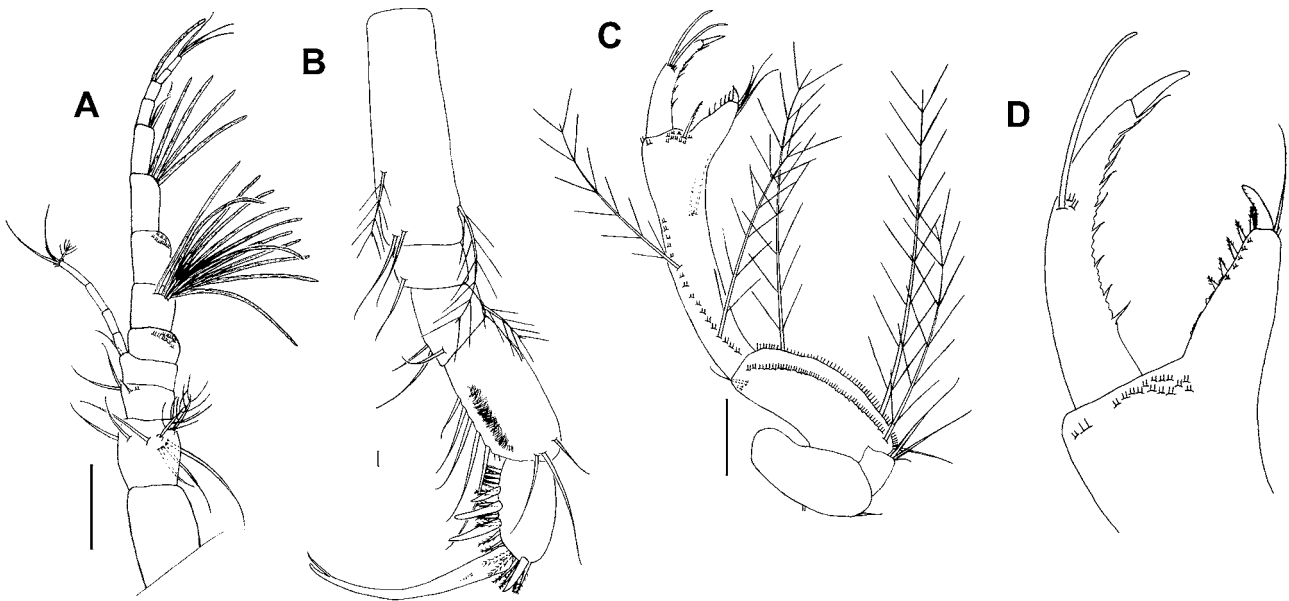


FIGURE 6. *Mesokalliapseudes quadriflagellata* n. sp., adult male. A, antennule (basis broken off); B, cheliped (inner view); C, chela (inner view); D, pereopod 6 (outer view). Scale bars: A, B = 0.2 mm; D = 0.1 mm.

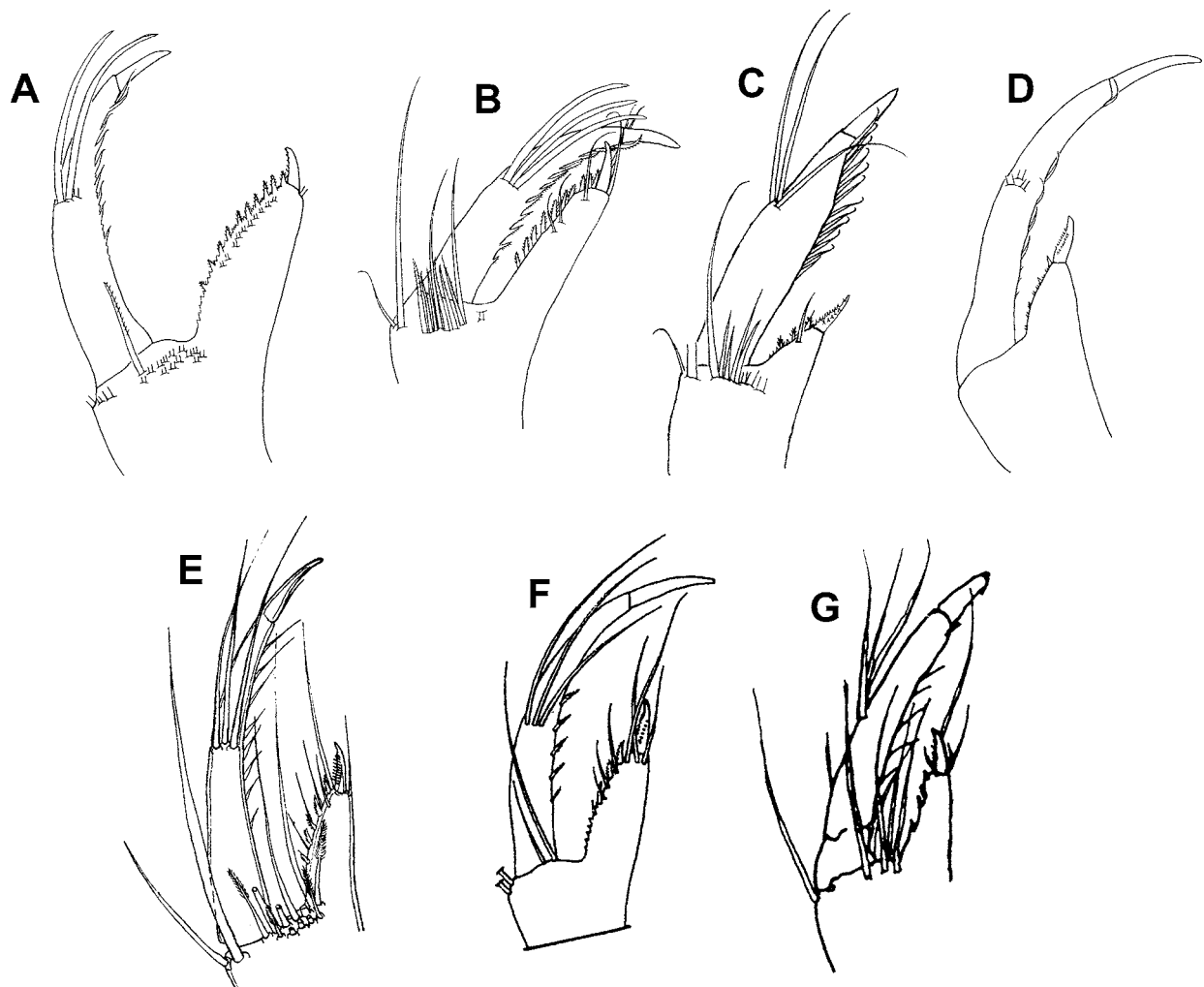


FIGURE 7. Chelae of all seven species of *Mesokalliapseudes*. A, *M. quadriflagellata* n. sp.; B, *M. crassus*; C, *M. bahamensis*; D, *M. brasiliensis*; E, *M. viridis* modified after Menzies, 1953; F, *M. thalasispeleus* modified after Guțu, 2006; G, *M. soniadaunae* modified after Bamber, 1993.

Pleopods (Fig. 5D). Basal article with two long plumose inner setae. Exopodite biarticulate with one plumose seta on first article and 16 plumose setae on distal article. Endopodite uniarticulate with 17 plumose setae.

Uropod (Fig. 5E). Exopodite with short basal article with one simple seta followed by two longer articles, last article approximately 1.5 times as long as second article and terminating in four simple setae. Endopodite multiarticulate (exact number unknown due to incomplete fusion in some articles).

Male. Similar to female but with the following differences:

Antennule (Fig. 6A). First four articles of main flagellum each with cluster of aesthetascs.

Pereopod 6 (Fig. 6B). Dactylus nearly as long as carpus and propodus combined.

The cheliped is illustrated (Figs. 6C, D) in order to show that it is nearly identical to the female cheliped.

Manca. Exopodites on the last two pairs of pereopods present.

Distribution. Known only from Puerto Rico, 0.8–57 m (Figs. 1,8).

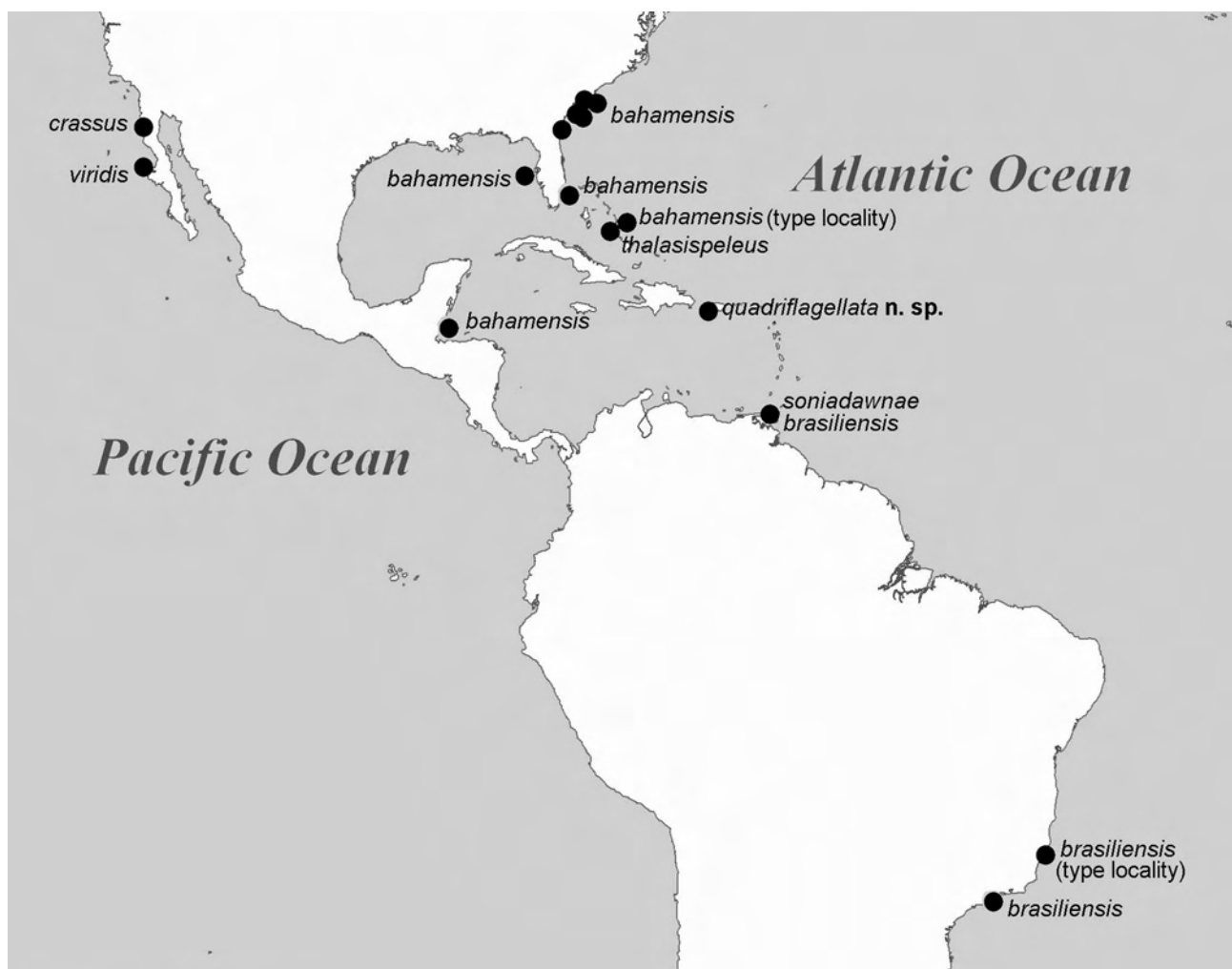


FIGURE 8. Distribution map of species belonging to the genus *Mesokalliapseudes*.

Remarks. *Mesokalliapseudes quadriflagellata* n. sp. can be distinguished from its congeners by the following combination of characteristics: 1) fixed finger of propodus more than two-thirds the length of the dactylus, and 2) inner flagellum of antennule with four articles. The only other congener that has the fixed finger of the propodus more than two-thirds the length of the dactylus is *M. crassus* (Menzies, 1953), but this species has a pointed rostrum, a more robust first peduncular article of the antennule, the antenna being more setose and with a distinct spinulate process on the third peduncular article, and the pereopod 6 being more setose and spinose. *Mesokalliapseudes quadriflagellata* also appears to be closely related to *M. soniadaewnae* Bamber, 1993, but can be distinguished by lacking anterolateral apophyses on the pereonites and by having a

serrate spiniform seta on the first pereopod basis not as robust as that of *M. soniadaewnae*. *Mesokalliapseudes quadriflagellata* is unique in having the inner flagellum of the antennule with four articles (all other congeners have three articles).

The nature of the chelae (i.e. ratio of fixed finger/dactylus length; spination on cutting edges) appears to be one of the most important characters for differentiating species of *Mesokalliapseudes*. Figure 7 shows the chelae in all seven nominal species. Based on the morphology of the chelae, a potential *quadriflagellata/crassus* (Menzies, 1953) and *bahamensis* Sieg, 1982/*viridis* (Menzies, 1953) relationship is supported which would make these two species-pairs trans-isthmian geminates. This can only be tested with a robust molecular phylogeny because a recent morphology-based cladistic analysis (Drumm, 2010) could not resolve the relationships within this genus. It has been shown that morphological similarities may hinder the accurate identification of trans-isthmian geminate species pairs (Lessios, 1998; Craig *et al.*, 2004).

The distribution of this genus occurs exclusively in the New World (western Atlantic/northeastern Pacific) (Fig. 8), and it would be interesting to investigate the role, if any, of the rise of the Isthmus of Panama over 16–3 million years ago (Coates and Obando, 1996) in the speciation of this group. The Isthmus of Panama separated the Pacific and Atlantic Ocean basins and created a barrier to gene-flow between marine organisms on either side, causing a large number of closely related species (geminant species pairs) to occur along the Atlantic and Pacific coasts. It is peculiar that no species have been discovered off the west coast of South America. This might be due to low sampling effort. It is expected that new species are yet to be discovered in the eastern Pacific.

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CHAPTER V

Descriptions of the two new species of Leptocheliidae Lang, 1973 (Crustacea: Peracarida: Tanaidacea: Tanaidomorpha) from the coastal waters of Puerto Rico, with keys and taxonomic observations.

Morales-Núñez, A.G., Heard, R.W., and Alfaro, M. Descriptions of the two new species of Leptocheliidae Lang, 1973 (Crustacea: Peracarida: Tanaidacea: Tanaidomorpha) from the coastal waters of Puerto Rico, with keys and taxonomic observations.



Abstract

Based on benthic samples collected from coastal waters of Puerto Rico, two new leptocheliid tanaidaceans, *Pseudoleptochelia juliae* and *Pseudonototanaïs oglei*, are described, respectively, from off La Parguera and Culebra Island. Based on the morphology of the male cheliped, *Pseudoleptochelia juliae*, n. sp. has affinities with *P. anomala* (Sars), *P. fairgo* Bamber, *P. magna* (Smith), and *P. mortenseni* Lang, which are designated as the “anomala group”. The male of the new species is most similar to that of *P. fairgo* from western Australia, but it is distinguished by the male cheliped having a subacute process on the posterior margins of the carpus and propodus (in *P. fairgo* they are blunt). The status of the species currently assigned to the genus and possibly related genera are discussed. *Pseudonototanaïs oglei*, new species is distinguished from the inadequately described and illustrated *P. werthi* (Vanhöffen) by having the male antennule distinctly longer with five aesthetasc-bearing flagella articles (four in *P. werthi*) and the female being more elongate. The female of *P. oglei* is separated from those of *Pseudonototanaïs anorexia* (Bird and Bamber), n. comb.; *P. bransfieldensis* Sieg; and *P. ebriosus* Bamber and Bird by having the distal margin of the maxillipedal basis with three, instead of two, pairs of long simple setae. The male of *P. oglei* differs from that of *Pseudonototanaïs longidactylus* (Băcescu), n. comb., by the cheliped having a longer and narrower fixed finger on the propodus relative to the length of the dactylus and the antennule having fewer (5) aesthetasc-bearing flagella articles (6 in *P. longidactylus*).

Key words: Tanaidomorpha, new species, *Pseudoleptochelia*, *Pseudonototanaïs*, Caribbean, Puerto Rico.

Introduction

This study represents the third in a series (Morales-Núñez et al 2010; Drumm and Morales-Núñez (2010) Heard and Morales-Núñez (in review) on the poorly documented tanaidacean fauna of Puerto Rico. Previous to these three recent studies, only six species of Tanaidacea were reported from Puerto Rico and adjacent waters. The first species reported from the area was *Podictenius* (= *Apseudes*) *espinosus* Moore, 1901, which was described from the nearby island of St. Thomas. Some 75 years later Messing (1977) described *Neotanaïs persephone* from the Puerto Rican Trench at depths greater than 6000 m. The first tanaidacean records from the coastal waters of Puerto Rico were established by Stoner (1986) for *Leptochelia forrestii* Stebbing 1896 and *L. dubia* Krøyer 1842, from a shallow-water grass bed habitat near Mayagüez. More recently, Hansknecht et al. (2002) described *Tanapseudes gutui* Hansknecht, Heard and Bamber, 2002, which was collected adjacent to the Carolina Waste Water treatment Plant (WWTP) near San Juan.

As part of our present studies of the Tanaidacea of Puerto Rico, Drumm and Heard (2010) established the first record for the kallipseudid *Psammokalliapseudes granulosus* Brum, 1973 from eastern Puerto Rico at a depth of 28 m off Isla de Culebra. From the same locality Morales-Núñez et al. (2010) and Heard and Morales-Núñez (in review) described the apseudomorphans, *Saltipedis* (*Spinosalripedis*) *puertoricensis* Morales-Núñez, Heard, and Alfaro, 2010 and *Echinoparapseudes alfaroe* Heard and Morales-Núñez (in review) respectively. At a different location, Drumm and Morales-Núñez (2010) described the new kallipseudid species, *Mesokalliapseudes quadriflagellata* Drumm and Morales-Núñez, 2010 from southwestern Puerto Rico off La Parguera at depths ranging from 1 to 58 m.

Our paper deals with the descriptions of two new Puerto Rican, shallow-water (12-28 m) tanaidaceans belonging to the genera *Pseudonototanaïs* Lang, 1973 and *Pseudoleptochelia* Lang, 1973.

Materials and Methods

The specimens of *Pseudoleptochelia* Lang, 1973 were found in the vicinity of North San Cristobal keys at Southwest of La Parguera, Puerto Rico (Fig. 1) at depth of 12.2 m.

Organisms were obtained with a benthic grab in June 18th of 2008. The specimens of *Pseudonototanaïs* Lang, 1973 were diver-collected using PVC core sampler (8.8 cm in diameter) from a depth of 28.m in the vicinity of Culebra Island off the eastern coast of Puerto Rico (Fig. 1) These collections were made every two months between October 2002 and October 2003 and took place on soft bottom substrata in a 120 by 100 m (12,000 m) area. Sample processing followed that of Morales-Núñez and Kornicker (2007).

Type material has been deposited in the National Museum of Natural History, Smithsonian Institution, Washington DC, (USNM), Gulf Coast Research Laboratory Museum, Ocean Springs, Mississippi MS, (GCRL), and Invertebrate Collection, University of Puerto Rico at Mayagüez (UPRM), Puerto Rico, USA. All measurements are in millimeters (mm). Total body length (TL) is measured from the tip of the rostrum to the end or tip of the telson. The terminology used in this report, unless otherwise stated, follows that of Larsen (2003).

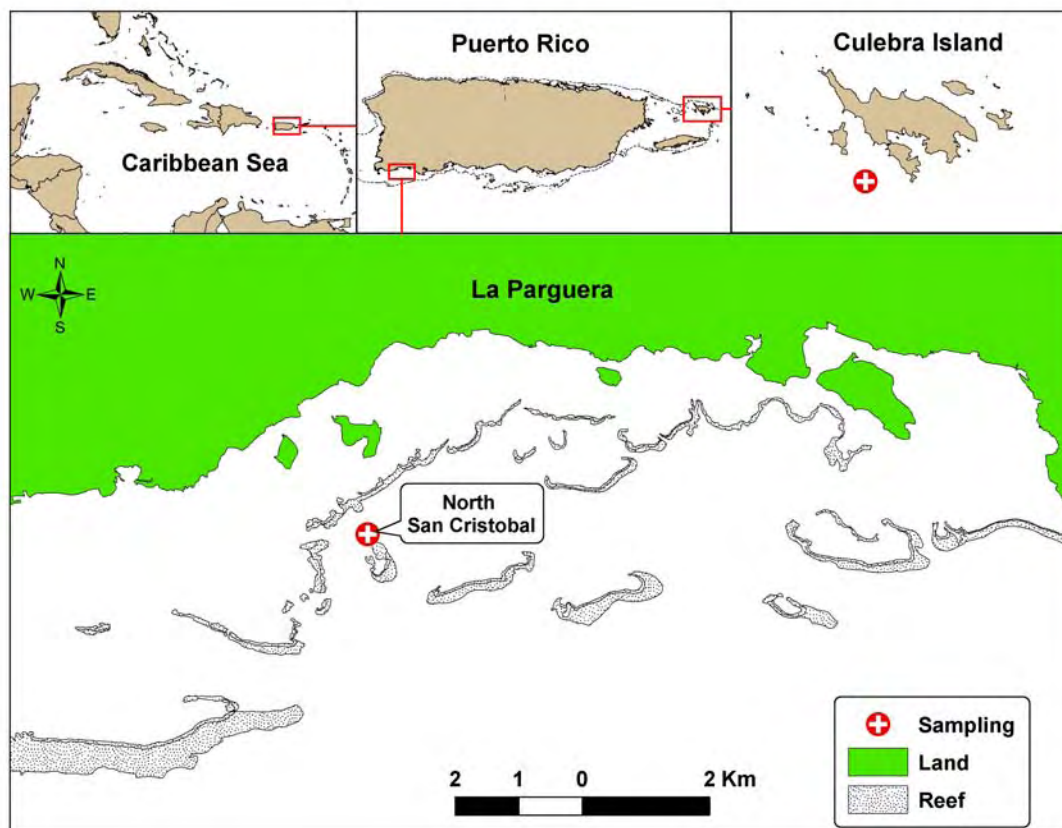


Figure 1 Geographic location of La Parguera, Southwest Puerto Rico, and Culebra Island, Eastern Puerto Rico, indicating the sampling stations where *Pseudoeptochelia juliae* n. sp., and *Pseudonototanaïs* n. sp., were found.

Systematics

Suborder Tanaidomorpha Sieg, 1980

Superfamily Paratanaidoidea Lang, 1949

Family Leptocheliidae Lang, 1973

Genus *Pseudoleptochelia* Lang, 1973

Pseudoleptochelia juliae n. sp.

Figs. 2–6, 7B

Material examined. Holotype, Adult male [Form A], length 2.2 mm, (USMN 000000), 17° 56.831N, 67° 04.714W, North San Cristóbal Southwest of La Parguera, Puerto Rico, depth 12.2 m, collected in June 18 of 2008. **Paratypes** (same collection data as for holotype): two males, two females (USMN 000000); two males (GCRL 0000), two females (GCRL 0000); two females (UPRM 0000). Additional specimens from the type locality are in the collection of authors.

Etymology. — This species is named in honor of Julia Stella Núñez, the mother of the senior author.

Type locality. – 56.831N, 67° 04.714W, North San Cristóbal Southwest of La Parguera, Puerto Rico, depth 12.2 m, soft substrata (sand).

Distribution. — Presently know only from the type locality.

Description. — Adult Female.

Body (Fig. 2A): Length 2.6–3.2 mm, about 7.5 times width.

Cephalothorax (Fig. 2A): Subequal length of 2 and 3 pereonites combined; ocular lobes with eyes having visual elements present; with three simple setae on each side, near to disto-laterally margin; 18 % of total length.

Pereonites (Fig. 2A): Pereonites 1, 2, 3, 4 and 6 wider than long; pereonite 5 longer than wide; pereonite 1 to 3 with one simple setae on each side, disto-laterally; 60 % of total length.

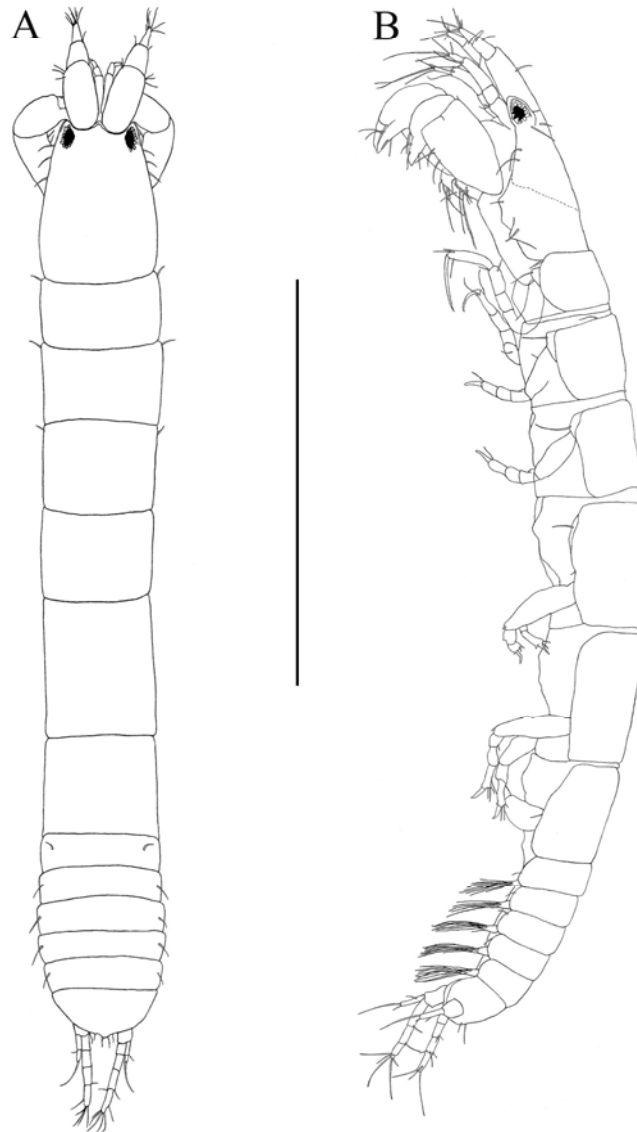


Figure 2. *Pseudoleptochelia juliae* **n. sp.**, Paratype female: A, dorsal view; B, lateral view. Scale line: A – B = 1.0 mm

Pleonites (Fig. 2A): Slightly shorter than pereonites 2 and 3 combined; pleonites 1 to 5 sub-equal in length, wider than long; pleonite 1 with one simple setae on medial-dorsal margin; pleonites 2 to 5 with one simple setae on mid dorsolateral margins, dorsally; about 16-18 % of body length.

Pleotelson (Fig. 2A) sub-equal in length to pleonites 4 and 5 combined, with four medial terminal simple setae; about 5 % of total body length.

Antennule (Fig. 3A) relatively short, stout about 1/7 total body length, with three apparent articles; article 1 about 2.2 times width, longer than succeeding two articles combined, with two (1 dorsal and 1 ventral) simple setae on the middle margin, with four broom setae on ventral middle margin, with one simple setae and two broom setae on sub disto-ventral margin; article 2 slightly longer than wide, with two (1 dorsal and 1 ventral) simple setae and one broom setae on the distal margin; article 3 about 2.5 times width, with three simple distal setae (2 long, 1 short); terminal article, minute, with four simple setae (2 long and 2 much shorter) and one broom setae.

Antenna (Fig. 3B) with six articles; article 1 naked; article 2 slightly longer than wide, with two small simple setae on the each distal margins; article 3 quadrate, with one simple setae on the disto-dorsal margin; article 4 with length about 3.1 times width, with four (2 short and 2 long) simple setae on the sub-distal; article 5 about 2.5 times as long as wide with two long simple setae on the sub-distal margin; article 6 minute with four (2 short and 2 long) simple setae.

Mouthparts: Labrum (Fig. 3C) with a few setae on distal margin.

Mandible (Figs. 3D–F): Left mandible *lacinia mobilis* subtriangular with subdistal denticles (Fig. 3D), incisor with one small proximal and two weak shallow distal lobes (Fig. 3E). Right mandible incisor with five proximal denticles on upper margin, weakly bidentate distally (Fig. 3F). *Molar process* stout, with grinding surface having fine denticulation.

Labium (Fig. 3G): Bilobed and wide, distally finely setose.

Maxillule (Fig. 3H): Endite having 9–10 distal spines, sub-distal and outer margin setose; palp slender with two long terminal setae of unequal length.

Maxilla (Fig. 3I): Subquadrate.

Maxilliped (Fig. 4A): Basis fused, distal margin usually with 4, occasionally 5, pairs of long simple setae, extending to second palp article; endites not fused, with finely setose lateral margins and strong lateral spiniform setae, three distal tooth-like spines, and inner lobes with two stout denticles. *Palp*: article 1 naked; article 1 with simple setae on the outer margin and three simple setae on the sub-distal inner margin; article 3 with five simple

setae on inner margin; article 4 with seven distal simple setae, and simple setae near to middle.

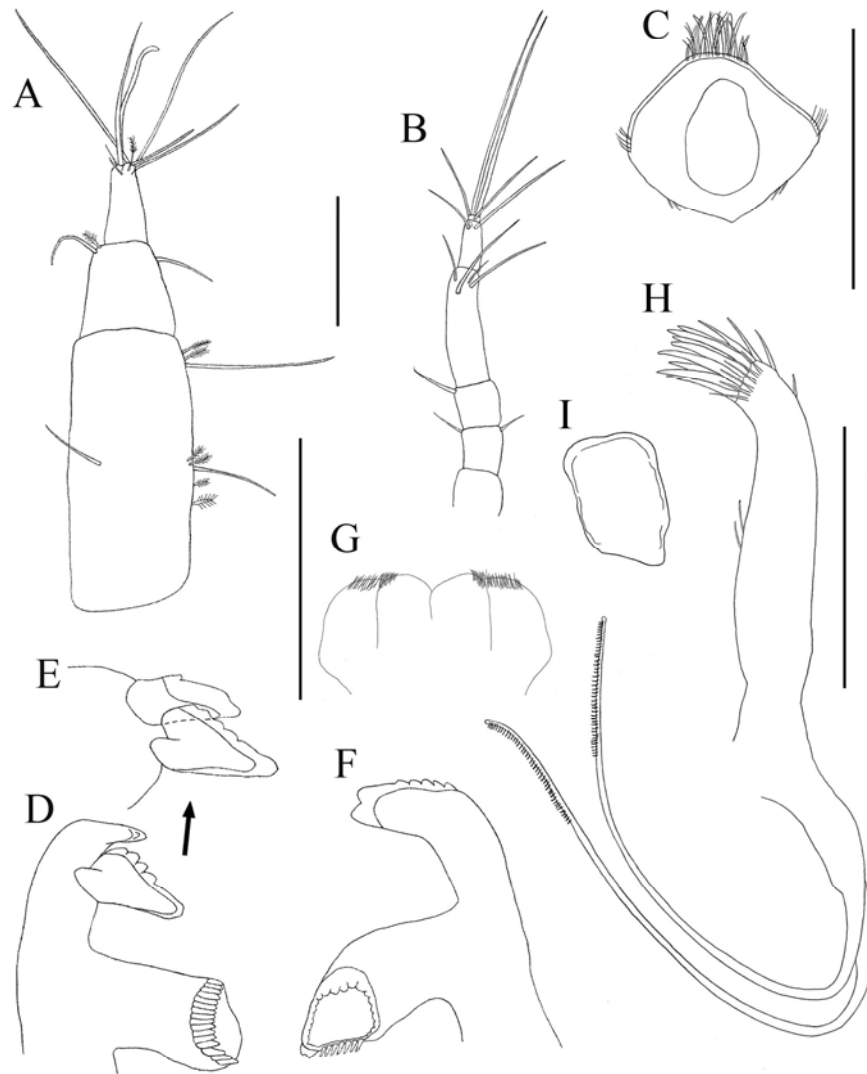


Figure 3. *Pseudoleptochelia juliae* n. sp., Paratype female: A, antennule, lateral view; B, antenna, lateral view; C, labrum; D, left mandible; E, enlargement of lacinia mobilis and incisor process; F, Right mandible; G, labium; H, maxillule; I, maxilla. Scale line: A – D and F – I = 0.1 mm

Epignath (4B): Elongate, with entirely margin finely setose.

Cheliped: Lateral view (Fig. 4C): Sclerite attachment: basis elongate about 2.5 times as long as wide with one simple setae on sub-distal lateral margin; merus triangular with two row of simple setae on the ventral margin, each row bearing four simple setae; carpus about 1.8 times longer than wide with two longer simple setae on ventral margin; propodus about

1.9 times as long as wide with one distal simple setae near at articulation of dactylus; fixed finger with three simple setae on outer incisive margin and one simple setae ventrally; dactylus strong, longer than fixed finger. *Inner view* (Fig. 4D): propodus with row of setules and two broom setae near at articulation of dactylus; fixed finger with simple setae on the middle of outer margin; dactylus with simple setae near at proximal margin.

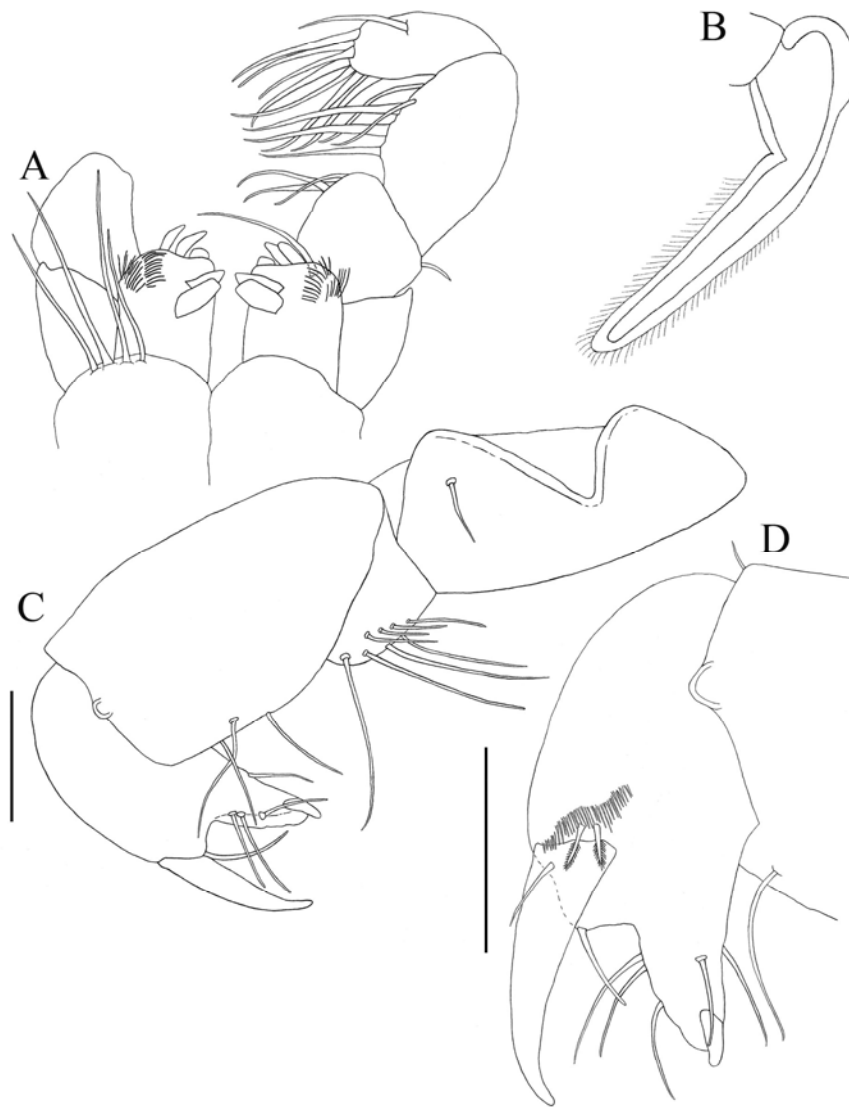


Figure 4. *Pseudoleptochelia juliae* **n. sp.**, Paratype female: A, maxilliped; B, epignath; C, left cheliped, lateral view; D, right cheliped, inner view. Scale line: A – D = 0.1 mm

Pereopod 1 (Fig. 5A): Longer than others five pereopods; coxa with one simple setae; basis slender about 3.3 times as long as wide, with dorso-proximal simple setae; ischium

about 3 times wider than long and one simple ventral setae; merus naked, about twice as long as wide; carpus about 2.8 times as long as wide, with two (1 short and 1 long) disto-dorsal simple setae and three ventro-distal simple setae; propodus about 3.6 times as long as wide, with three (1 small and 2 long) sub-distal simple setae on dorsal margin and one sub-distal long simple setae on ventral margin; dactylus and unguis together longer than propodus..

Pereopod 2 (Fig. 5B): Coxa with one simple setae; basis about 3.0 times as long as wide, with dorsal simple setae; ischium about 3.3 times wider than long and one simple ventral setae; merus naked, about 1.6 times as long as wide; carpus about 1.6 times as long as wide, with two disto-dorsal short simple setae and one disto-ventral simple setae; propodus about 2.6 times as long as wide with two dorso-distal simple setae; dactylus and unguis together almost half of propodus, dactylus longer than unguis with proximal setae, curved and not fused.

Pereopod 3 (Fig. 5C): Similar to pereopod 2, except for presence of two broom-seta on anteroproximal margin of basis.

Pereopod 4 (Figs. 5D; G–H): Basis length about 2.3 times width with two broom-setae on posterior margin and cluster of minute setae on mid-anterior margin; ischium about 3 times wider than long, with simple seta; merus length about 1.4 times width, with two disto-ventral tubercles each bearing single setae (Fig. 5G); carpus length about 1.3 times width, with three stout spine each with fine outer setule (Fig. 5H); propodus about 2.5 times as long as wide, with one stout setae and one simple setae disto-ventrally, with five (2 long simple, 1 single sided setulated and 2 short) setae dorsally; dactylus and unguis combined almost half length of propodus, dactylus longer than unguis, curved and not fused Similar to pereopod 3 except: propodus with two stout simple setae ventrally, with two tubercles each bearing simple setae and two single side setulate setae disto-dorsally; dactylus and unguis together almost half length of propodus, dactylus longer than unguis with proximal seta, curved and not fused.

Pereopod 5 (Fig. 5E): Similar to pereopod 4 except: ischium with two simple setae on ventral margin; propodus with two subequal long simple setae and [one curved pectinate?] one single sided setulate setae disto-dorsally; dactylus and unguis nearly as long as third part of propodus.

Pereopod 6 (Fig. 5F): Similar to pereopod 5 except: ischium with two simple setae on ventral margin; propodus about 3.7 times longer than wide, with two unequal simple setae and three [pectinate?] single sided setulate setae disto-dorsally.

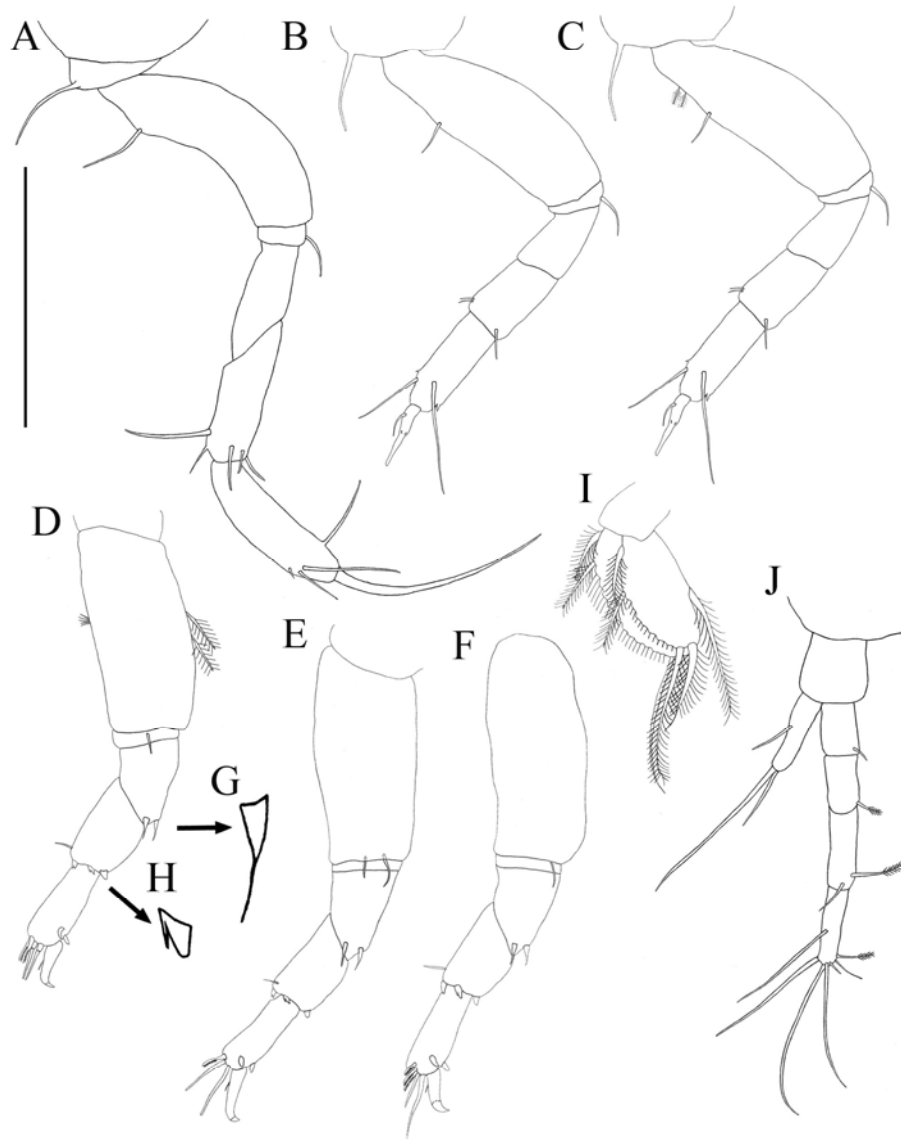


Figure 5. *Pseudoleptochelia juliae* n. sp., Paratype female: A – F, pereopods 1 – 6, respectively; G, enlargement of tubercle bearing single setae; H, enlargement of stout spine with fine outer setule; I, pleopods; J, uropods. Scale line: A – F and I – J = 0.2 mm.

Pleopods (Fig. 5I): Five similar, well-developed, biramous pairs. Basal articles broad, asetose. Rami with, lengths slightly more than twice widths, both with proximally inflated plumose seta on distal inner margin adjacent to articulation with basis. Exopod (outer ramus) with inner and distal margins bearing nine long plumose setae, distal most seta

modified (greatly attenuated and filament-like distally; lateral margin with single strongly developed plumose seta. Endopod (inner ramus) with inner and distal margins bearing 14 long plumose, outer margin asetose.

Uropod (Fig. 5J): Biramous, basis lacking setae; exopod with one article, exceeding second endopod article, with [med-lateral simple seta?] middle outer simple setae, with two distal simple setae, inner distal setae as long as third part of outer distal setae; endopod with four articles; article 1 almost half length of exopod, with inner distal simple setae; article 2 about 1.9 times as long as wide, with inner distal broom setae; article 3 almost same length of exopod, with one simple setae and broom setae on inner distal margin; article 4 almost same length of exopod, with one simple setae on the middle of outer margin, with five (3 long, 1 short and 1 small) simple setae and one broom setae on inner distal margin.

Male. *Body* (Fig. 6A): Smaller than female. Length about 2.0–2.3 mm.

Cephalothorax (Fig. 6A) nearly as long as pereonites 1 to 3 combined, rostrum undeveloped; ocular lobes bearing large eyes with visual elements present, eyes 5 times (aprox.) larger than in female; about 25 % of total carapace length.

Pereonites (Fig. 6A): Pereonites 1 to 4 progressively longer; pereonite 5 same length that pereonite 4; pereonite 6 same length that pereonite 3; pereonite 1 to 3 wider than long; pereonite 4 and 5 same length, and quadrate; about 50 % of total length.

Pleonites (Fig. 6A): As long as pereonites 5 and 6 combined; all pleonites sub-rectangular, and wider than long; pleonite 1 with one small simple setae on middle-lateral margin; pleonites 2 to 5 with two small simple setae on middle-lateral margin; 20 % of total length.

Pleotelson (Fig. 6A): As long as pleonite 1; with two pair of small setulate setae on disto-dorsally margin; apex of posterior margin with two long simple setae and two small simple setae; 5 % of total length.

Antennule (Figs. 6A–C): Peduncle of three articles: Article 1 about 1.7 times longer than wide with disto-dorsal simple setae; article 2 about 1.6 times longer than as wide, with disto-ventral rounded apophysis; article 3 with strong disto-dorsal setae. Flagellum; excluding proximal most and distal most articles, having 12 articles with each proximally with row of aesthetascs (Fig. 6A); proximal-most article forming shelf over next one or two

articles, with small simple seta dorsally (Fig. 6C); distal most article minute, with simple terminal setae (Figure 6B).

Antenna (Fig. 6A): with four articles: article 1 and 2 with disto-dorsal simple setae; article 3 about 3.7 times as long as wide, with mid-dorsal simple setae and one disto-ventral simple setae; article 4 about 6.5 times as long as wide, with five (3 long and 2 short) simple setae distally.

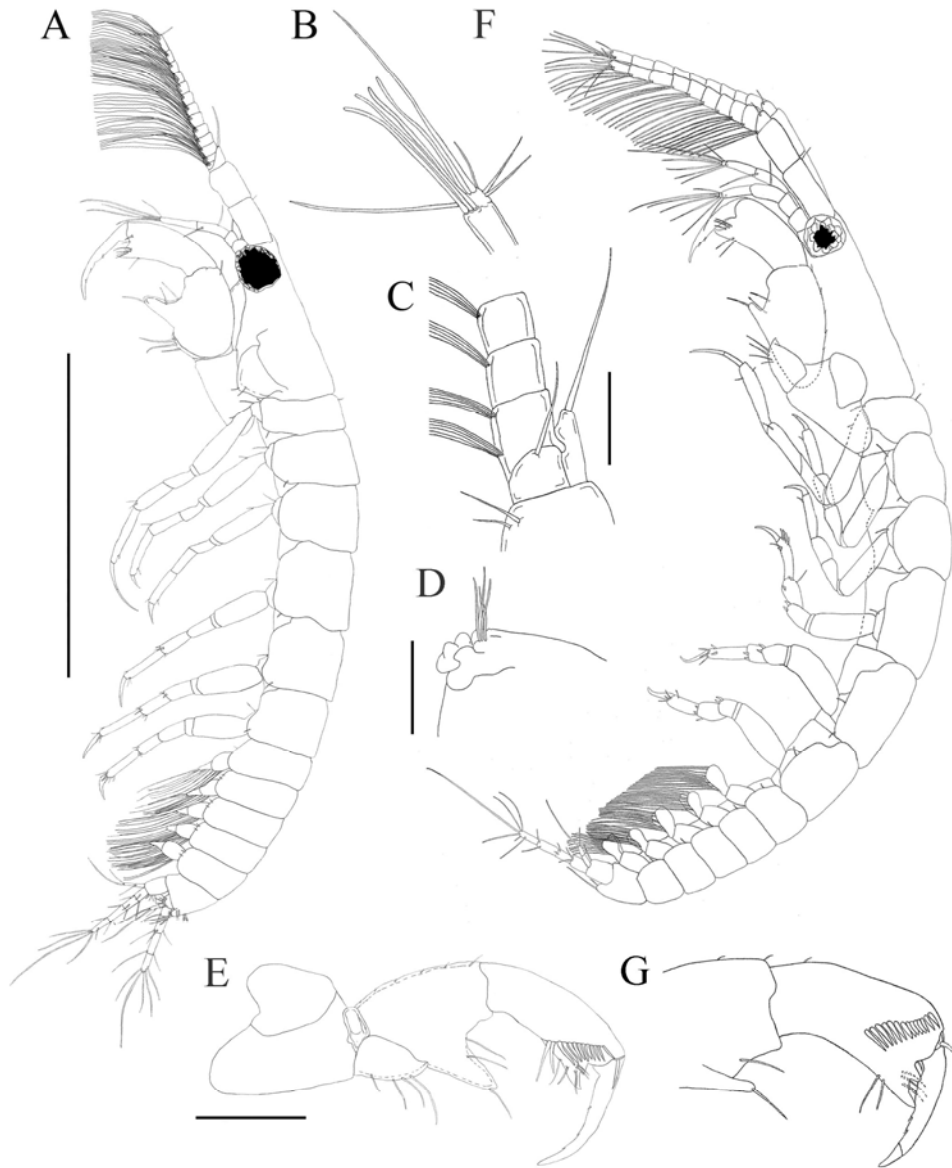


Figure 6. *Pseudoleptochelia juliae* n. sp., Holotype male (form A): A, male, lateral view; B, enlargement of tip antennule; C, enlargement of antennule; D, maxilliped; E, left cheliped, inner view. Paratype male (form B): F, male, lateral view; G, left cheliped, inner view. Scale line: A – B = 1.0 mm; C – E, and G = 0.1 mm

Mouthparts: Unrecognizable, atrophied mass.

Maxilliped (Fig. 6D): atrophied, area of basis with four simple setae; palps small, with two recognizable, partially fused articles.

Cheliped: Inner view (Fig. 6E): subchelate type; Basis 2.1 times as long as wide; merus triangular with four (3 distal and 1 proximal) simple setae ventrally; carpus with disto-ventral apophysis bearing three (1 distal- outer and 2 proximal-inner) simple setae, with six small simple setae on dorsal margin; propodus about 2.6 times as long as wide; fixed finger a small pointed apophysis, with five inner (3 dorsal and 2 ventral) simple setae; and row of 11 short and two longer setae sub-distal near base of dactylus; dactylus slender, as long as propodus, with one simple setae near at proximal margin, with row of fine setae along cutting edge.

Remarks. As pointed out by Bamber (2005: p 704) the genera *Pseudoleptochelia*, *Leptochelia*, and *Pseudonototanaïs* share have many similarities making the assignment of some of their taxa, especially when only females are known, questionable. This appears to be particularly relevant to the taxonomic status of species presently assigned to the genus *Pseudoleptochelia*. Fourteen nominal species were previously attributed to the genus *Pseudoleptochelia* (Anderson 2010; Table 1). Of these, only *P. mortenseni* Lang, 1973, described from Tobago, is the only member of the genus previously known from the northwestern Atlantic (Anderson 2010). Based largely on the thick, compressed antennule of the female and late stage neuters, we tentatively place *P. juliae*, **n. sp.** and *P. fairgo* with the herein designated “anomala group,” which also contains *P. anomala* (Sars, 1882) and *P. magna* (Smith, 1906). The general distributions for these and the other nominal species attributed to *Pseudoleptochelia* are listed in Table 1; however, excluding the “anomala group” the remaining nominal species may be referable to other genera or they are so inadequately described and illustrated to allow reliable taxonomic placement.

Table 1. Alphabetical listing of the 14 previously recognized species for the genus *Pseudoleptochelia* Lang, 1973 *sensu lato*, plus *P. juliae* **n. sp.**, including information on distribution and depth range (based on Bird and Bamber, 2000; Anderson 2010).

Species range	Geographical area	Depth range (m)
<i>anomala</i> (Sars, 1882) [type species]	Mediterranean (Zanzibar)	37
<i>anorexia</i> Bird & Bamber, 2000	Indo-Pacific (South China Sea)	10–30
<i>antarcticus</i> (Lang, 1953)	Antarctic (Falkland Island)	0–358
<i>bulbus</i> Bamber, 2006	New Caledonia, Loyalty Is. (France)	12–20
<i>fairgo</i> Bamber, 2005	Australia (Esperance, Queensland)	23–39
<i>filum</i> (Stimpson, 1853)	NE Pacific (NZ), US Pacific coast	0.5–138
<i>inermis</i> (Dollfus, 1898a)	NE Atlantic (Dakar)	7
<i>juliae</i> n. sp.	Southern NW Atlantic (Puerto Rico)	12
<i>longidactylus</i> (Băcescu, 1977)	Mediterranean (Libya)	70
<i>magna</i> (Smith, 1906)	Mediterranean (Naples)	Littoral
<i>mercantilis</i> (Smith, 1906)	Mediterranean (Naples)	Littoral
<i>mergellinae</i> (Smith, 1906)	Mediterranean (Naples)	Littoral
<i>mortensenii</i> Lang, 1973	Caribbean (Tobago)	Littoral
<i>provincialis</i> (Dollfus, 1898)	Mediterranean (St. Tropez)	50
<i>straddi</i> Bamber, 2008	Australia (Queensland)	10

The male and female of *Pseudoleptochelia juliae* **n. sp.**, appear to be most similar to those of *P. fairgo*, a species known from Australia (Bamber 2005, 2008). The males of both species have a prominent carpal process making them appear nearly carpochele (Figs. 6A, E, 7B; and 7D, respectively). This distinctive carpal process is absent or underdeveloped on the other subchele males assigned to the genus (see Figs. 7A, E–K). Bamber (2008) described *Pseudoleptochelia straddi* based on the male co-occurring with *P. fairgo*. Whether *P. straddi* and the “Form B Male” illustrated and diagnosed here represent cryptic species or different forms of *P. fairgo* and *P. juliae*, respectively, remains to be determined. In both cases the all the females examined from their respectively areas appeared morphologically similar. As stated by Bamber (2008) resolution of this problem may only solved by molecular comparisons. The females of both *P. juliae* and *P. fairgo* differ from those known for the other nominal species (except possibly *P. anomala* and *P. provincialis*) by usually having (1) basis of maxilliped with four pairs of long simple setae on distal margin , and (2) distinctive stout setulate and distally attenuated seta on pereopods 4–6 (Fig. 5 D–F). They also share an atypical condition for the subfamily Leptocheliinae Lang,

1973 by lacking the distinctive buttressed thorn setae on the distal margins of their second and third antennal articles; a characteristic that, at least superficially, may link these two species, and possibly the other members of “anomala group,” to the subfamily Heterotanaidinae Larsen and Wilson, 2002.

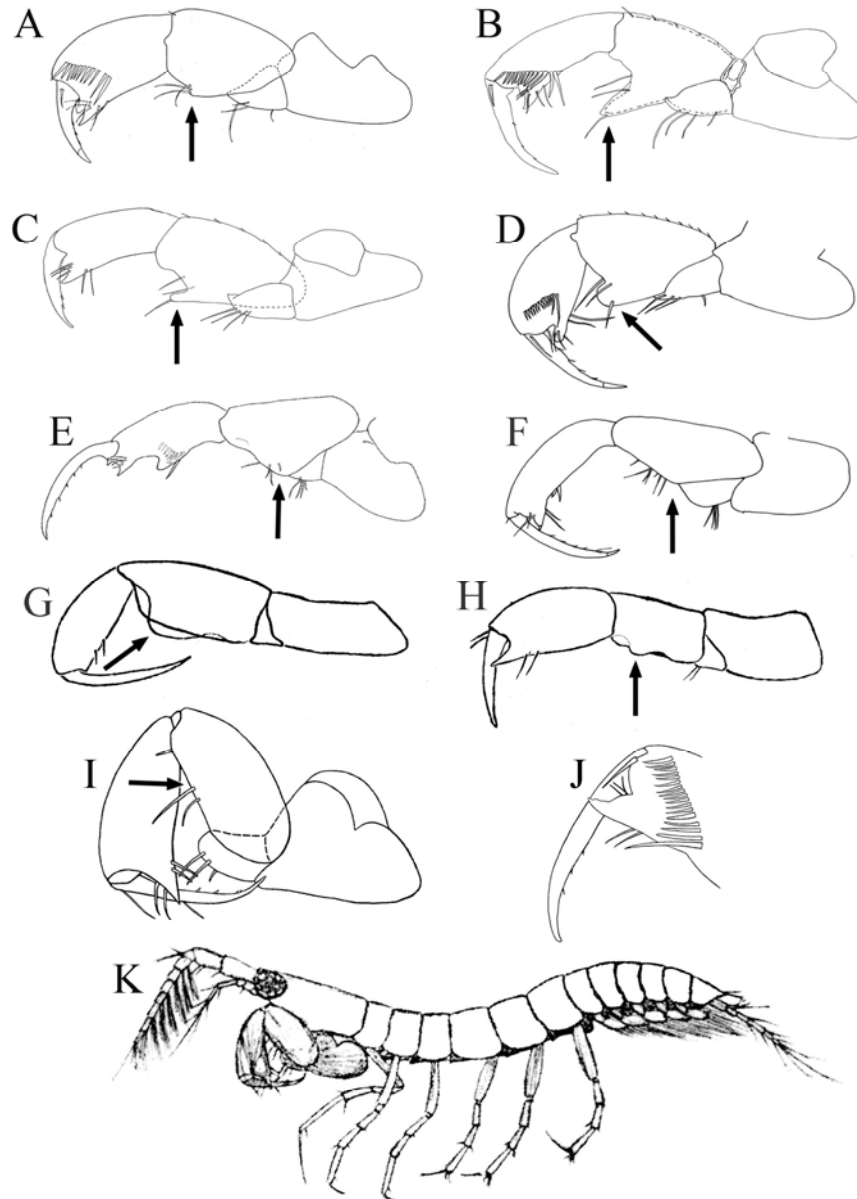


Figure 7. Examples of *Pseudoleptochelia* male's having a prominent carpal process or underdeveloped carpal process in merus of cheliped. A, *Pseudoleptochelia mortenseni*; B, *P. juliae* (male form A); C, *P. juliae* (male form B); D, *P. fairgo*; E, *P. straddi*; F, *P. bulbus*; G, *P. provincialis*; H, *P. algiricus*. I, *P. anomala*; J, *magna*; K, *P. anomala* (lateral view). [Figures from: Lang 1973 (A); Bamber 2005 (D); Bamber 2008 (E); Bamber 2006 (F); Dollfus 1898 (G–H); I and K, Sars, 1882; J, Smith 1906.

The male of *Pseudoleptochelia juliae* can be distinguished from that of *P. fairgo* by having the ventral carpal and propodal processes on the cheliped sub-acute to acute (both blunt and rounded in *P. fairgo*); the females are separated by *P. juliae* having (1) more “spatulate spines” on the distal medial inner margins of the maxillipedal endites, (2) a greater number of setae on the merus of the cheliped (8 verses 5), and (3) apparently fewer articles/pseudoarticles in the uropodal endopod (4 verses 5).

As discussed above another *Pseudoleptochelia* male (Form A) co-occurred with the males and females attributed to *P. juliae*. Though similar (see Fig. 6F) in many aspects to the male holotype of *P. juliae* there some distinct differences. The following diagnosis is given for separating “**Male Form A**” from that of *P. juliae sensu stricto*: *Body* (Fig. 6F), length 1.6–1.8 mm, appearing less compact than male of *P. juliae*. *Antennule* (Fig. 6F), with peduncle articles 1 and 2 slightly longer than that of *P. juliae*; flagellum with 9 aesthetasc bearing articles. *Cheliped*: Lateral aspect (Figs. 6F; 7A), with carpus having slight bulge on posterior margin with simple setae and with six small spiniform setae on anterior margin. Inner aspect (Fig. 6G) propodus with subdistal, oblique comb-row of 13–14 stout setae gradually increasing in length anteriorly; fixed finger of propodus with gap between tooth and unguis. *Pereopods* (Fig. 6F), similar to *P. juliae* form, but all pereopods appearing more slender and pereopods 1–3 having merus, carpus, and propodus appearing slightly longer.

The male of *P. juliae*, **n. sp.** and the *Pseudoleptochelia* Form A male, are distinguished from that *P. mortenseni*, the only other member of the genus known from the NW Atlantic, by having a chela with a distinct process on the posterior carpal margin; on the carpus of *P. mortenseni* there is only raised bump with three associated simple setae (Fig. 6F, 7A). The chelae of the two species different further in the row of setae on the inner subdistal face of the propodus (see Figs. 6E, 7B; 6F, 7A, respectively). There are 13 setae becoming gradually longer posteriorly (ventrally) on *P. juliae* (Figs. 6E; 7B) and male Form A; whereas, on *P. mortenseni* the setal row is irregular with 11 setae; the first seta is longer than all but the last two, which are subequal and distinctly longer than all the rest (Fig. 7A). Further, the antennule of the “Form A” has 10 aesthetasc bearing flagella articles (excluding minute tip); whereas, that of *P. mortenseni* has seven such flagella articles. The male of *P. juliae* has 12 aesthetasc-bearing articles.

There is a possibility that *P. juliae* and the *Pseudoleptochelia* Form A male, respectively, may represent two sympatric, cryptic species for which their respective females appear to be indistinguishable, which might also be case for *P. fairgo* and *P. straddi*. If so there is a reasonable possibility that another male form for *P. mortenseni* may exist in the southern Caribbean. Another possibility is that the sympatric males from these regions may represent polymorphic forms of the same species, as seen in *Leptochelia dubia* (see Heard et al. 2004). Notwithstanding resolution of this question awaits future developmental and molecular studies.

The generic status of the other nominal species listed by Anderson (2010) is unclear and most, if not all, may not belong to *Pseudoleptochelia sensu stricto* (this paper). Bamber and Bird (1997, p 133) suggested that *P. filum* has affinities with and may referable to the genus *Pseudonototanaïs* Sieg, 1968. The illustrations and description given for *P.* (= *Heterotanaïs*) *antarcticus* are more reminiscent of the primary males of some species of *Leptochelia* (e.g., *L. dubia* complex), which have a relatively small and similar male chela (not appearing subchelate) and only four articles in the inner ramus of the uropod. Additionally, the antennal peduncles for the female of *Pseudoleptochelia antarcticus* are more typical of *Leptochelia* or *Pseudonototanaïs*. The presence, however, of only two pairs of long simple distomarginal setae on maxillipedal basis is not typical of *Leptochelia*, but more like *Pseudonototanaïs*. Lang (1973: Fig. 15k) illustrates two pairs setae for a female attributed to *P. mortenseni* in contrast to the four pairs found on the maxillipedal basis of *P. fairgo* and *P. juliae*. Further, the elongate antennule (see Figure 15c) is similar to that of *Leptochelia* or *Pseudonototanaïs*. In Lang's next figure (16g) the antennule attributed to *P. mortenseni* is distinctly different and similar to that of *P. fairgo* and *P. juliae*. Also the antenna of the female "*P. mortenseni*" depicted in Fig 15d has the buttressed "thorn" setae on articles 2 and 3, which is characteristic of *Leptochelia* and *Pseudonototanaïs*, and its uropodal endopod is more reminiscent of the latter genus. On several occasions we have observed the co-occurrence of the genera *Leptochelia*, *Pseudoleptochelia*, and *Pseudonototanaïs* in samples from Florida (USA), Mexican Caribbean, and Puerto Rican waters (R. Heard and A. Morales-Núñez, per. observ.). Based these observations, there is a reasonable possibility that the female illustrated in Figure 15 of Lang 1973 is not *P. mortenseni*, but that the antennule of the female illustrated in his Fig 16g is. Using the same

criteria (e.g., two pairs of simple basal setae on maxilliped, non compressed antennule, and thorn setae on antenna), *Pseudoleptochelia anorexia* Bird and Bamber, 2000, has more affinities with genus *Pseudonotanaïs* sensu Bamber 2000 than to the members of the “anomala group.” Further, based on a comparison of the illustrations and descriptions for female of *P. anorexia* with those for the female attributed to *P. mortenseni* in Figure 15 of Lang 1973, the two species appear to be quite similar and are probably congeneric. The taxonomic status of *P. provincialis* (Dollfus, 1898) can not resolved until the type material or topotypic specimens of both sexes have been redescribed or described in detail, respectively. Regarding *P. longidactylus* (Băcescu, 1977), this species appears to have affinities with *Pseudonotanaïs*. See “remarks” under the description of the new *Pseudonotanaïs* described in this paper.

The generic status of the well described *P. bulbosus* Bamber, 2006 is clouded. The male cheliped superficially resembles those within the “anomala group,” but the third article does not form a dorsal shelf over the first one or two flagella article as found in members of the group. This “article” may actually be a composite of two articles in which a dorsal “scale-like” third peduncular article, having a well-developed terminal simple seta (see Fig 6C), and the first flagella article are partially fused. Notwithstanding this scale-type of peduncular article appears to be absent in the known males of the genera *Leptochelia* and *Pseudoleptochelia*. Also, unlike *P. fairgo* and *P. juliae*, the female *P. bulbosus* has (1) a distinctive *Leptochelia*-like elongate antennule, (2) buttressed thorn setae on the distal margins the second and third antennal articles, and (3) five pairs of simple setae on distal margin of the maxillipedal basis. For these reasons we did not include it in the “anomala group,” and question generic status with the possibility similarity of the male chelae may be do homoplasy. It should be noted that the males of some other tanaidomorphans have a similar scale-like third peduncle article of the antennule (e.g., males *Paratanaïs*); these are homologous or derived remains to be determined.

In our opinion the remaining species currently listed under *Pseudoleptochelia* (i.e., *P. inermis*, *P. mercantilis*, and *P. mergellinae*) are also not referable to this genus. Of these “*P. inermis*” may represent a primary male of *Leptochelia*. The other two species, which also have males with chelate chelae, require detailed study to resolve their taxonomic status.

Bamber (2006) recently described genus *Konarus* Bamber, 2006 based on female and neuter forms. This species shares several characters with the *Pseudoleptochelia* “anomala group,” the most striking being the similarly stout and compressed antennule. Also as in the females of *P. juliae* and *P. fairgo*, its antenna appears to lack the characteristic buttressed thorn setae that characterize the subfamily Leptocheliinae Lang, 1973. Whether these similarities are due to homoplasy or commonly derived characters awaits the description of its male and molecular comparisons between the two genera. *Pseudoleptochelia* is distinguished from *Konarus* by having (1) fewer articles in uropodal endopod, (2) lacking a distinct suture on the carapace, and (3) the shape of the female chela.

The subchelate condition exhibited by the members of the “anomala group” appears to occur in several different tanaidomorphan families, subfamilies, and generic groups [e.g., *Heterotanais oerstedii* (Krøyer, 1842); *Leptochelia myora* Bamber, 2008; *Tangalooma rous* Bamber, 2008; *Nototanais dimorphus* (Beddard, 1886); *Pseudonototanais werthi* (Vanöhhfen, 1914)]. Whether some or all of these various subchelate forms are derived independently or are synapomorphies remains an open question.

As pointed out by G. Bird (per. comm. Nov. 2010), our conclusions are tempered by the fact that the type species for *Pseudoleptochelia*, *Heterotanais anomalas*, was described from a male specimen (female unknown). Based on the descriptions of the females attributed to *P. (Heterotanais) anomala* sensu Smith (1906) and *P. (Heterotanais) magna* by Smith (1906), we believe that female of *P. anomala sensu stricto* will prove to have the characteristic stout antennule and an antenna lacking buttressed thorn setae as exhibited by *P. fairgo* and *P. juliae*, n. sp. If this should prove otherwise, then our concept of an “anomala group” will have little credence.

Genus *Pseudonototanais* Lang, 1973

***Pseudonototanais oglei* n. sp.**

Figs. 8 – 12

Material examined, Holotype. Adult male, length 2.0 mm, (USMN 000000), 18°16'21.81''N, 65°19'09.01''W, 3.2 km Southwest of Culebra Island, Puerto Rico, depth

28 m, collected between October 2002 and October 2003. **Paratypes** (same collection data as for holotype): one male, two female (USMN 000000); one male (GCRL 0000), two females (GCRL 0000); two females (UPRM 0000). Additional specimens from the type locality are in the collection of authors.

Etymology. — Species is named in honor of John Ogle in recognition of his pioneering work on the Tanaidacea of the Gulf of Mexico and for his many contributions to crustacean mariculture.

Type locality. – 18°16'21.81''N, 65°19'09.01''W, 3.2 km Southwest of Culebra Island, off eastern Puerto Rico, depth 28 m, soft substrata (sand).

Distribution. — Puerto Rico, presently known only from the type locality.

Description. Adult Female.

Body (Fig. 8A): Length about 2.7 mm, about 12.5 times as long as wide.

Cephalothorax (Fig. 8A) with length about 1.5 times width; longer than first two pereonites combined; ocular lobes with eyes having visual elements present; 19 % of total length.

Pereonites (Fig. 8A): Pereonites 1, 2, 3, 5 and 6 sub-rectangular, and wider than long; pereonite 4 rectangular longer than wide; about 65 % of total length.

Pleonites (Fig. 8A): As long as pereonite 4; all pleonites subequal; 14 % of total length.

Pleotelson (Fig. 8A): Subequal length at first pleonite with four apical simple setae, and single lateral small on each side; 3 % of total length.

Antennule (Figs. 9A–B): Relatively long (a little less 1/5 length) with three distinct articles plus one apparent minute terminal article. Article 1 length about 3.6 times width with three broom setae on proximal-lateral margin, two setae (1 broom, 1 simple) on mid-lateral margin and three setae (1 simple, 2 broom) on distolateral margin; article 2 about 1/3 length of first article, with three (2 ventral and 1 medial) simple setae distally; article 3 almost half length article 1 with three simple distal setae (2 long, 1 shorter); terminal article,

minute, with four simple setae (2 long and 2 much shorter) and one apparent broom setae (Fig. 2B).

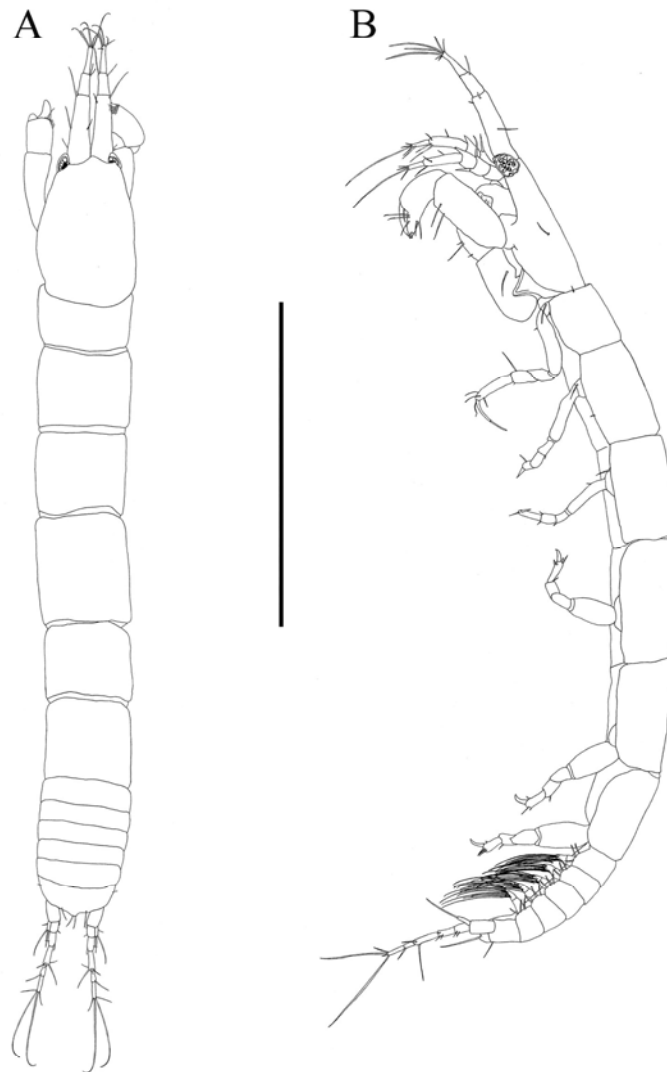


Figure 8. *Pseudonototanaïs oglei* n. sp., Paratype female: A, antennule, lateral view; B, enlargement of tip antennule; C, antenna, lateral view ; D, labrum; E, left mandible, F, lacinia mobilis; G, right mandible; H, labium; I, maxillule; J, enlargement of tip maxillule; K, maxilla. Scale line: A and C = 0.2 mm; D – E; G – I and K = 0.1 mm

Antenna (Fig. 9C) with six articles: article 1 short, aetose; article 2 with two (1 dorsal, 1 ventral) relatively long distal thorn seta (as long or longer than article 2), one anteriorly curved on anterior dorsal margin and one on ventral margin, and two small setae on mid lateral face; article 3 with spinose process on disto-dorsal margin; article 4 length equals combined lengths of articles 2 and 3, with six distal or subdistal simple setae and one

simple seta on mid-dorsal margin; article 5 with two (1 dorsal and 1 ventral) distal simple setae; article 6 minute with five (2 short and 3 long) simple setae.

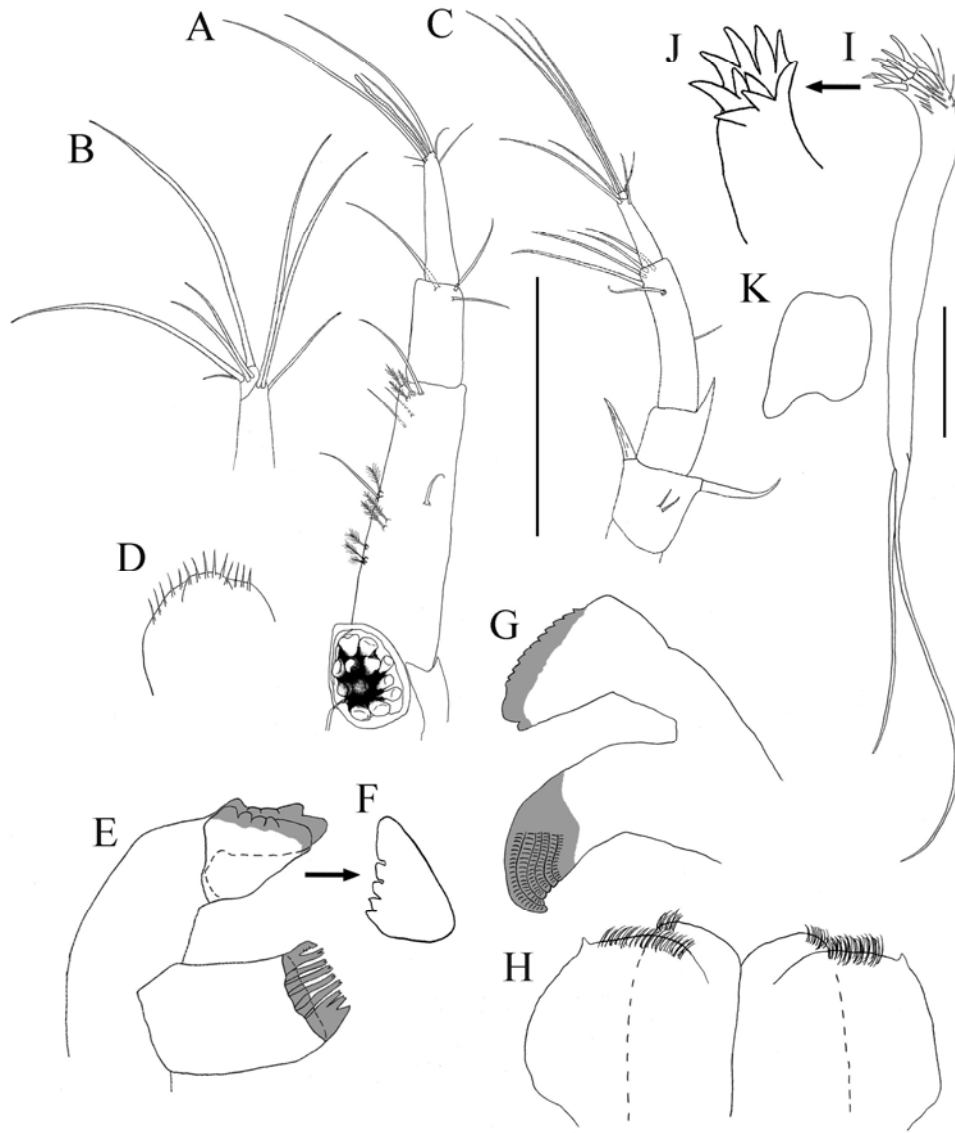


Figure 9. *Pseudonototanis oglei* n. sp., Holotype female: A, antennule, lateral view ; B, antenna, lateral view ; C, labrum; D, right mandible; E, lacinia mobilis; F, labium; G, maxillule. Scale line: A – B = 0.2 mm; C – G = 0.1 mm

Mouthparts: Labrum (Fig. 9D) broadly rounded and distal edge finely setose.

Mandibles (Figs. 9E–G): Left mandible with *lacinia mobilis* crenulate with four low lobes, the outer largest (Fig. 9F). Right mandible with broad incisor, with bifid tip and crenulate upper margin, *molar process* serrate (Fig. 9G);

Labium (Fig. 9H): Bilobed, distally setose.

Maxillule (Fig. 9I–J): Endite having cluster of several simple setae and ten distal spines (Fig. 9J); palp longer than endite, with two long terminal setae of unequal length.

Maxilla (Fig. 9K): As illustrated.

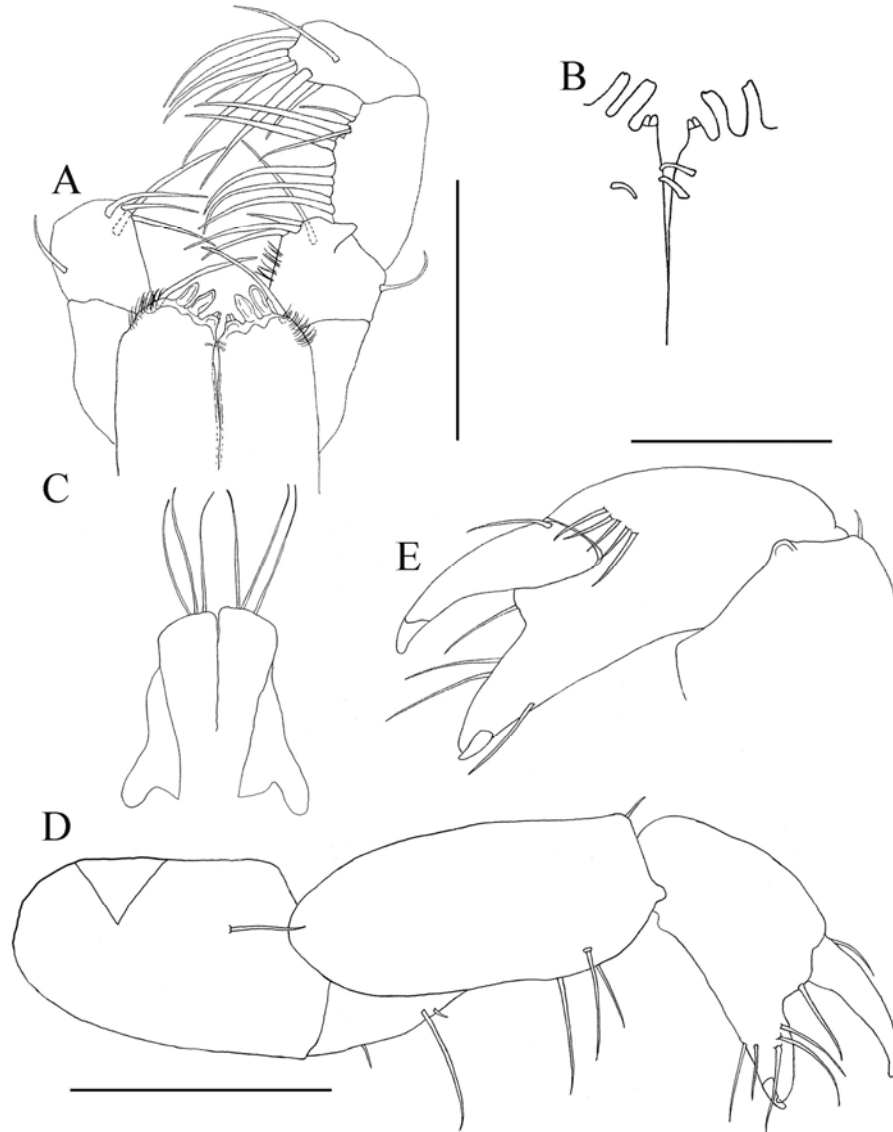


Figure 10. *Pseudonototanaïs oglei* n. sp., Paratype female: A, maxilliped; B, enlargement inner distal margin of endite; C, basis of maxilliped, ventral view; D, right cheliped, lateral view; E, left cheliped, lateral view. Scale line: A and C = 0.1 mm; D and E = 0.3 mm

Maxilliped (Figs. 10A–C): Basis having proximal third of endites fused, distal margin with three pairs of long simple setae (Fig. 10C), with finely setose lateral margins, and strong lateral spiniform setae, two distal tooth-like spines, and inner lobe with one denticle (Figs. 10 A–B). *Palp*: article 1 naked; article 2 with outer lateral spiniform setae, with three

medial simple setae and row of 9 small setae; article 3 with seven simple setae on distal-inner margin; article 4 with seven distal simple setae, and one simple setae near middle.

Cheliped: Lateral aspect (Fig. 10D) showing coxal (=sclerite) attachment. Basis length about 1.6 times width with lateral simple setae on outer margin; merus triangular, with three (2 short and 1 long) simple setae ventrally; carpus length 2.3 times width, with disto-dorsal simple setae, and three ventral simple setae; propodus length about twice width; fixed finger with two ventral simple setae, and three simple setae on cutting/grasping margin; dactylus and unguis nearly 1/3 length of propodus with simple setae dorso-proximally, curved and not fused. *Inner aspect* (Fig. 10E): propodus having five comb setae (anterior and posterior most distinctly longer than inner three); dactylus with simple seta dorsally adjacent to articulation with propodus.

Pereopod 1 (Fig. 11A): Longer and more attenuated than Pereopods 2–6; coxa with one simple setae (Fig. 8A); basis slender, with length about 4.7 times width, with dorso-proximal simple setae; ischium naked, width about four times length; merus naked, length about 1.5 times width; carpus about 1.5 times as long as wide, with two (1 short and 1 long) dorso-distal simple setae and one ventro-distal simple setae; propodus about 4.3 times as long as wide, with five sub-distal simple setae and one distal simple setae; dactylus and unguis together longer than propodus and not fused.

Pereopod 2 (Fig. 11B): Coxa with one simple setae (Fig. 8B); basis slender about 5.1 times as long as wide, with small simple setae, dorsally; ischium naked, about 1.8 times wider than long; merus about 2.3 times as long as wide, with one dorso-ventral simple setae; carpus about 2 times as long as wide, with short simple setae on ventro-subdistal margin; propodus about 2.4 times as long as wide, with two sub-distal spines on dorso and ventral margin, and two sub-distal simple setae, dorsally; dactylus and unguis shorter than propodus and not fused, with two (1 near to middle and 1 distal) simple setae on dorsal-margin.

Pereopod 3 (Fig. 11C): Similar to pereopod 2.

Pereopod 4 (Fig. 11D): Smaller than others 5 pereopods; basis stout and naked, about 1.7 times as long as wide; ischium naked, about 11 times wider than long; merus about 2.3 times as long as wide, with two sub-distal ventral spines; carpus about 1.1 times as long as wide, with two stout spiniform setae each with fine outer setule, and one simple setae on

distal margin; propodus about 3.3 times as long as wide, with three stout (2 sub-distal and 1 distal) spiniform setae each with fine outer setule on the ventral margin, with two (1 longer than dactylus and unguis together and 1 short) simple setae and pinnate setae on disto-dorsal margin; dactylus and unguis almost half of propodus, curved and fused.

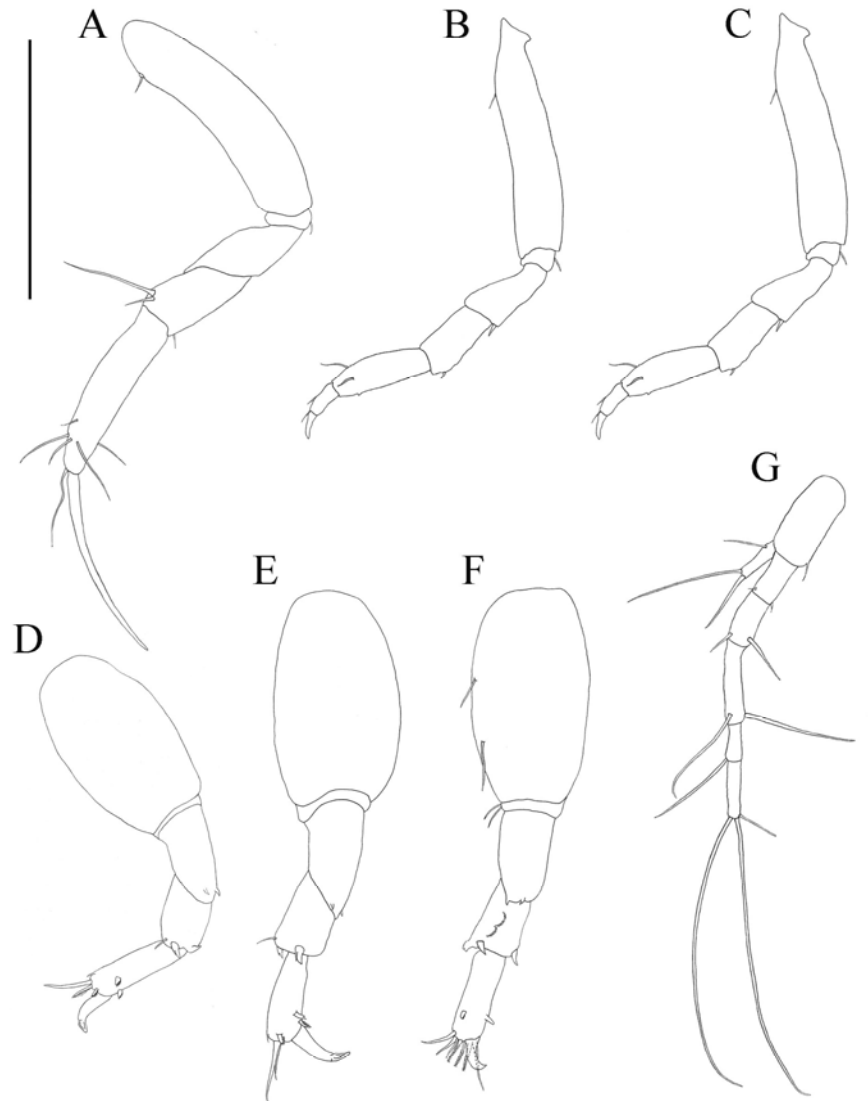


Figure 11. *Pseudonototanaïs oglei* **n. sp.** *Pseudonototanaïs oglei* n. sp. Paratype female: A – F, pereopods 1 – 6, respectively; G, uropods. Scale line: A – G = 0.2 mm

Pereopod 5 (Fig. 11E): Similar to pereopod 4 except: largest than pereopod 4; ischium naked, about 6.5 times wider than long; dactylus and unguis than longer as carpus.

Pereopod 6 (Fig. 11F): Basis stout with two simple setae in the middle on dorsal margin, about 1.8 times longer than wide; ischium triangular and naked; merus about 2.1

times as long as wide, with two sub-distal spines; carpus with three stout spiniform setae each with fine outer setule; propodus with two sub-distal stout spiniform setae each with fine outer setule, four (3 dorsal and 1 ventral) simple setae, distally, and three distal bipinnate setae; dactylus and unguis nearly as long as third part of propodus, curved and fused

Pleopods (Fig. 11H): Five similar, well-developed, biramous pairs. Basal articles broad, aetose. Rami with, lengths slightly more than twice widths, both with proximally inflated plumose seta on distal inner margin adjacent to articulation with basis. Exopod (outer ramus) with inner and distal margins bearing eight long plumose setae, distal most seta modified (greatly attenuated and filament-like distally; lateral margin with single strongly developed plumose seta. Endopod (inner ramus) with inner and distal margins bearing 18 long plumose, outer margin aetose.

Uropod (Fig. 11G): Biramous, basis with simple setae on distal inner margin; exopod with one article and slightly shorter than first endopod article, with simple setae on outer proximal margin and two simple setae, distally; endopod with four article; article 2 and 3 with incipient articulation; article 1 about 2.5 times as long as exopod, with two (1 outer and 1 inner) simple seta on the middle, and two simple setae sub-distally; article 2 about 3 times as long as wide with one distal simple setae on outer margin; article 3 with same length of exopodite and one simple setae on outer margin; article 4 about 4 times as long as wide and with three unequal simple setae, distally.

Male. *Body* (Fig. 12A). Length about 2.0-2.2 mm, about 12 times width; smaller than female.

Cephalothorax (Fig. 12A) with length slightly over twice width and equal to combined lengths of pereonites 4 and 5; sub-rectangular with simple setae on the middle of both lateral margin; ocular lobes with eyes having visual elements present; 25 % of total length.

Pereonites (Fig. 12A) 1, 2, 3 and 6 sub-rectangular, and wider than long; pereonite 5 square; pereonite 1 with disto dorso-lateral simple setae on both margin; about 60% of total length.

Pleonites (Fig. 12A): As long as pereonite 2 and 3 combined; all pleonites subequal, with short simple setae on the middle the both lateral margin; 16 % of total length.

Pleotelson (Fig. 11A): Subequal length at first pleonite, with four apical simple setae, and single lateral small on each side; 2 % of total length.

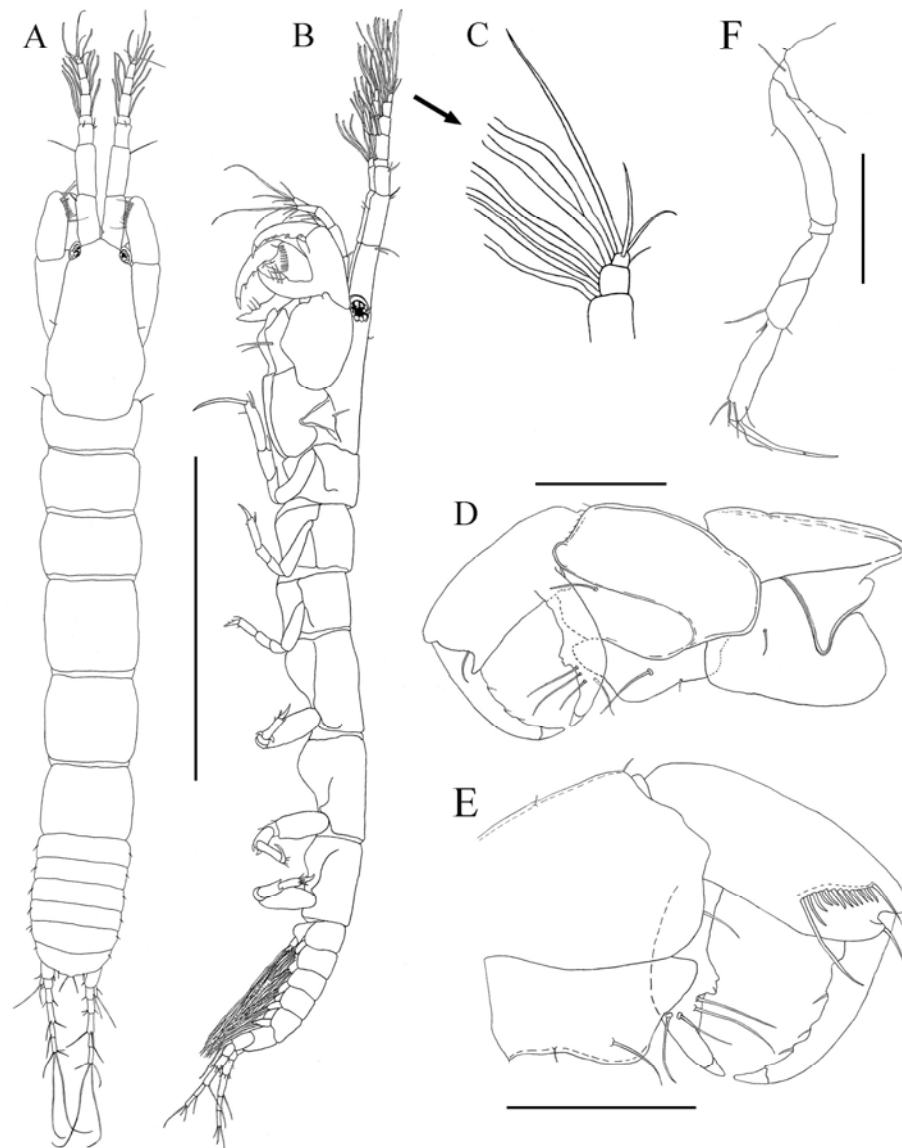


Figure 12. *Pseudonototanaïs oglei* n. sp. Holotype male: A, male, dorsal view; B, male, lateral view; C, enlargement of tip antennule; D, left cheliped, lateral view; E, left cheliped, inner view; F, pereopod 1. Scale line: A – B = 1.0 mm; D – F = 0.2 mm

Antennule (Figs. 12B–C) with nine articles: article 1 with length slightly more than 2.5 times width; with two disto-dorsal simple setae; article 2 with length about 2.5 times width, having two disto-dorsal simple setae and simple setae on mid ventral margin; article 3 about half length of article 2, with two disto-dorsal simple setae; article 4 much shorter than articles 3 and 5, length about 3.5 times width; article 5 as long as article 2; articles 6 and 7

subequal longer; article 8 ; article 9 minute with four (1 long, 2 short and 1 small) simple setae (Fig. 12C); articles 4 – 9 bearing proximal row of aesthetasc.

Cheliped: Lateral aspect (Fig. 12D): Sclerite narrowly and well developed; Basis about 1.6 times as long as wide, with one simple setae on medial lateral margin; merus sub-rectangular, with two (1 short, ventral and 1 long, lateral) simple setae; carpus with length slightly less than 2.5 times width, distal margin with fine setules, with one sub-distal simple setae ventrally and one short simple setae dorso-distal; propodus with length about twice width, having simple setae near base of dactylus; fixed finger with three simple setae on outer incisive (cutting) margin, with one developed denticle on mid inner margin; dactylus and unguis length nearly 1/3 that of propodus, with row of fine simple curved setae along cutting edge. *Inner aspect* (Fig. 12E) propodus having inner face with row of 13 setae (2 long and 11 relatively short) on subdistal margin near base of dactylus.

Pereopod 1 (Fig. 12F). Coxa with one long simple setae; basis slender, with width about 5 times as long as wide with dorso-proximal simple setae; ischium naked, about 4 times wider than long; merus naked with width about 2.3 times as long as wide; carpus about 2 times as long as wide with two (1 long, dorsally and 1 short, ventrally) simple setae, distally; propodus length nearly five times width, with two short simple setae on ventro-proximal margin, with four sub-distal simple setae and one distal simple setae; dactylus and unguis, not fused, together longer than propodus.

Remarks: *Pseudonototanaïs oglei*, **n. sp.**, is distinguished from other members of the genus by the female maxilliped having (3 instead of 2 pairs) basal simple setae and the male cheliped with propodus having a different number (13) and composition (2 long and 11 relatively short) of the “comb” setae on its inner subdistal face and the shape of the fixed finger. Unfortunately the type species, *P. werthi* (Vanhöffen, 1914), is inadequately described and illustrated, but based largely on its original illustrations; *P. oglei* differs by having its male antennule distinctly longer with five aesthetasc-bearing flagella articles (apparently only four in *P. werthi*) and the female being more elongate. The female of *P. oglei* is separated from those of *P. bransfieldensis* Sieg and *P. ebriosus* Bamber and Bird by having the basis of the maxilliped with three pairs of long simple setae on the distal margin (two pairs on *P. bransfieldensis* and *P. ebriosus*). The male of *P. oglei* differs from

that of *Pseudonototanaïs longidactylus* (Băcescu), n. comb., by the male cheliped having a longer and narrow fixed finger on the propodus relative to the length of the dactylus and antennule with fewer (five) number of aesthetasc-bearing flagella articles (seven in *P. longidactylus*). Based these observations, there is a reasonable possibility that the female illustrated in Figure 15 of Lang 1973 is not *Pseudoleptochelia mortenseni*, but that the antennule of the female illustrated is more like *Pseudonototanaïs*.

Based on the illustrations and text describing the female (male unknown) of *Pseudoleptochelia anorexia* Bird and Bamber, 2000, we believe that it has more affinities (e.g., number of basal setae on the maxilliped, presence of thorn setae on antenna) with females described for *Pseudonototanaïs bransfieldensis* Sieg and *P. ebriosus* and *P. oglei*, n sp. Because of these similarities and we here transfer it to the genus *Pseudonototanaïs* to become *Pseudonototanaïs anorexia* (Bird and Bamber, 2000), n. comb.

As mentioned earlier under the “Remarks” for *Pseudoleptochelia juliae*, *Pseudoleptochelia longidactylus* (Băcescu, 1977) appears to be referable to the genus *Pseudonototanaïs*, especially, based on the male antennule, antenna, and chela (assuming that the carpal lobe was not included in Băcescu’s illustration). Băcescu did not describe or mention the presence or absence of the “thorn setae” on the female antenna of *P. longidactylus*. Notwithstanding pending additional study of type or topotypic material were here transfer this species to become *Pseudonototanaïs longidactylus* (Băcescu, 1977), n. comb.

The status of the genus *Pseudonototanaïs* and the species presently assigned to it is clouded because of the insufficient morphological information for the type species *P. werthi*; however, based on the literature, the description of *P. oglei*, and the new combinations proposed in this paper, we tentatively recognize six species as now comprising the genus *Pseudonototanaïs*. There are at three additional yet to be described New World species, two from the Gulf of Mexico and southern Florida region of the NW Atlantic (i.e., “*Pseudonototanaïs* sp. A and B *sensu* Heard et al., 2004) and one from Isla de Coco of the Pacific coast of Costa Rica (R. Heard, T. Hansknecht, R. Vargas, per. observ.) for which both males and females are known. It is very probable that several additional species in this group will be found as more marine habitats are studied. It is possible that when

the type species is studies in detail that genus *Pseudonototanaïs sensu lato* may have to be divided into two or possibly three different genera (G. Bird, per. comm.2010).

Table 2. Alphabetical listing of the five currently recognized species for the genus *Pseudonototanaïs* Lang, 1973, plus *P. oglei* **n.sp.**, including information on distribution and depth range.

Species range	Geographical area	Depth range (m)
<i>anorexia</i> (Bird & Bamber, 2000), n. comb.	Hong Kong	10-30
<i>bransfieldensis</i> Sieg, 1986	Antarctic Peninsula (northwestern tip)	176–183
<i>ebriosus</i> Bamber & Bird, 1997	Hong Kong (Cape d' Aguilar)	6–14.5
<i>longidactylus</i> (Băcescu, 1977), n. comb.	Eastern Mediterranean Sea (off Libya)	70
<i>oglei</i>, n. sp.	Southern NW Atlantic (Puerto Rico)	28
<i>werthi</i> (Vanhöffen, 1914) [type species]	South Pacific	5–15

Key to Separation of known males of the genus *Pseudonototanaïs* Lang, 1973

1 Antennule with four aesthetasc-being flagella articles. Cheliped with propodus having fixed finger without one developed denticle on mid inner margin ... *P. werthi* (Vanhöffen, 1914) [South Pacific]

- Antennule with more than four aesthetasc-being flagella articles. Cheliped with propodus having fixed finger with one developed denticle on mid inner margin ... **2**

2 Antennule with five aesthetasc-being flagella articles. Cheliped having a longer and narrow fixed finger on the propodus relative to the length of the dactylus. Dactylus without curved in a semicircle. Cheliped having propodus with 13 anterior setae in comb ... *P. oglei* **n. sp.** [Puerto Rico]

- Antennule with seven aesthetasc-being flagella articles. Cheliped having a shorter and stouter fixed finger on the propodus shortest to the length of the dactylus. Dactylus with curved in a semicircle. Cheliped having propodus with 15 anterior setae in comb ... *P. longidactylus* (Băcescu, 1977) [Libya]

General ecological notes. The soft bottom type locality for *Pseudonototanaïs oglei* is just south of Isla de Culebra was at a site with submerged cages stocked with cobia (*Rachycentron canadum*) and mutton snapper (*Lutjanus analis*). During the period benthic studies indicated a significant increase in the diversity and species richness for the tanaidacean populations present (A. Morales-Núñez, per. observ.). Some of the other tanaidaceans co-occurring with *P. oglei* at this site included: *Spinosaltpedis puertoricensis* Morales-Núñez, Heard, and Alfaro, 2010, *Echinoparapseudes alfaroe* Heard and Morales-

Núñez (in review); *Psammokalliapseudes granulosus* Brum, 1973 (see Drumm & Heard 2010); *Tanapseudes gutui* Hansknecht, Heard, and Bamber, 2002; and *Leptochelia* spp. Tanaidaceans co-occurring with *Pseudoleptochelia juliae* at soft bottom sites off La Parguera included: *Mesokalliapseudes quadriflagellata* Drumm and Morales-Núñez, 2010; *Leptochelia* spp., *Pseudotanais* sp.; and *Swireapseudes* sp.

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CONCLUSIONS

This work represented a taxonomic contribution to the Tanaidacea Order and a contribution to the marine bio-diversity for the nerithic waters of Puerto Rico and for the Caribbean Sea.

Three new species of the Suborder Apseudomorpha are new records for Puerto Rico, the Caribbean and for sciences. The species *Saltipedis* (*Spinosalripedis*) *puertoricensis* is a new subgenus and a new species and was found at Culebra Island. *Echinoparapseudes alfaroe*, is a new genus and a new species, also found at Culebra Island, and *Mesokalliapseudes quadriflagellata* is a new species, found at La Parguera.

Also, two new species of the Suborder Tanaidomorpha are described for the first time: *Pseudoleptochelia juliae* and *Pseudonototanaïs oglei* and were found at Culebra Island and at La Parguera, Puerto Rico, respectively.

The tanaidacean fauna of Puerto Rico is poorly known and studies in this group have lagged behind compared to other regions. The new findings in this study reveal not only the lack of knowledge of this group since the new organisms were found in shallow waters, but also disclose the need to continue studying this group, as well as the benthic in-fauna.