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CARPOAPSEUDES HEARDI N. SP. (TANAIDACEA: APSEUDOMORPHA) FROM CARIBBEAN WATERS NEAR TOBAGO

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ABSTRACT: *Carpoapseudes heardi* n. sp. is described from samples collected from depths of 421 and 537 m off Tobago and is the first Caribbean record for the genus. The new species bears a resemblance to *Carpoapseudes serratospinosus* Lang, 1968 and other related species in the shortened dactylus unguis combination of pereopod 1, but has parallel eyespines like *Carpoapseudes bacescui* Guțu, 1975 and *Carpoapseudes simplicirostris* (Norman and Stebbing, 1886). Other diagnostic characters include pereopods 2 and 3 with basal spurs, labrum with paired lobes, labial palp with two terminal setae, maxillipedal bases with outer crenulations, and pleopods with 1-articled rami. It was found to lack an epistomal spine and has an unusual form of the third pereopod short propodal spine.

RESUMO: *Carpoapseudes heardi* sp. nov. é descrito de amostras coletadas em profundidades entre 421 e 537 m ao largo de Tobago, o primeiro registro do gênero no Caribe. A nova espécie se assemelha a *Carpoapseudes serratospinosus* Lang, 1968 e outras espécies no encurtamento da combinação dátilo-unguis no pereópodo 1, mas possui lobos oculares paralelos como *Carpoapseudes bacescui* Guțu, 1975 and *Carpoapseudes simplicirostris* (Norman e Stebbing, 1886). Outros caracteres diagnósticos incluem pereópodos 2 e 3 com esporas basais, labrum com lobos pareados, palpo labial com duas cerdas terminais, base do maxilípede com crenulações externas e pleópodos com ramo uniaarticulado. É diferenciada pela ausência do espinho do epistoma e possui um curto e incomum espinho no própodo do terceiro pereópodo.

INTRODUCTION

Recent deep-sea sampling efforts in the Caribbean Sea near Trinidad and Tobago conducted by Continental Shelf Associates (CSA) International Inc. under contract to Petro-Canada Trinidad and Tobago Ltd. have revealed a rich assemblage of tanaidaceans and other peracarideans. Samples were collected by CSA in the wet (November-December 2006) and dry (May-June 2006) seasons, and both collections included specimens of a new species of *Carpoapseudes*. Several other new apseudomorphs and tanaidomorphs were also found which will be the subject of future reports. Recent studies have shown that the ranges of some Caribbean deep-sea tanaids overlap with those in the Gulf of Mexico (GOM; T.J. Hansknecht, unpublished data), although no published records of the genus *Carpoapseudes* have been reported for GOM waters (Larsen 2005) or the Caribbean Sea. The nearest reported species (Larsen 1999) in the genus is *Carpoapseudes prospectnes* Larsen, 1999 from the South Atlantic off Brazil.

Guțu (1972) originally proposed the subfamily Leiopinae to include the genera *Carpoapseudes* and *Leiopus* Beddard, 1886 that have a first pereopod stronger than the following ones and a maxillipedal endite bearing a specialized inner distal seta with a leaf-shaped form. The genus *Carpoapseudes* Lang, 1968 consists of a group of 17 large, deep-sea apseudomorphs, from all major oceans. These tanaids are characterized by a lengthening of the carpus on pereopod 1 as compared to the merus (Guțu, 1980). In contrast, Băcescu (1982) reported *Carpoapseudes curtiscarpus* from the NE Atlan-

tic which is the first known species with a pereopod 1 carpus shorter than the merus, and *Carpoapseudes prospectnes* Larsen, 1999 as the first member of the genus with the carpus of pereopod 1 equal to the merus in length (Larsen 1999). Members of this genus also share a characteristic male cheliped morphology with a large triangular tooth on the propodal fixed finger. Guțu (1996) later presented a key to the thirteen known species of *Carpoapseudes* based, in part, on a comparison of the rostral lengths, pereopod 2 carpal length relative to that of the merus, and the length of the exopod relative to that of the basis of the cheliped. Other key characters included the number of antennule and antenna articles of the flagella and the presence or absence of branchial spines.

Other members of the genus have been described worldwide. For example, *Carpoapseudes caraspinosus* Dojiri and Sieg, 1997 was described from California and was the second species of the genus to be found with lateral spines on the carapace, and *Carpoapseudes spinigena* Bamber, 2007 and *Carpoapseudes varindex* Bamber, 2007 have recently been described from the Kurile-Kamchatka and the Japan trenches. The purpose of this study was to report the first occurrence of this genus in the Caribbean Sea and describe a new species of *Carpoapseudes*.

MATERIALS AND METHODS

Shipboard samples were collected by CSA using a 0.35-m² box corer, and infaunal samples were preserved in 10% formalin, stained with Rose Bengal, sorted, and then

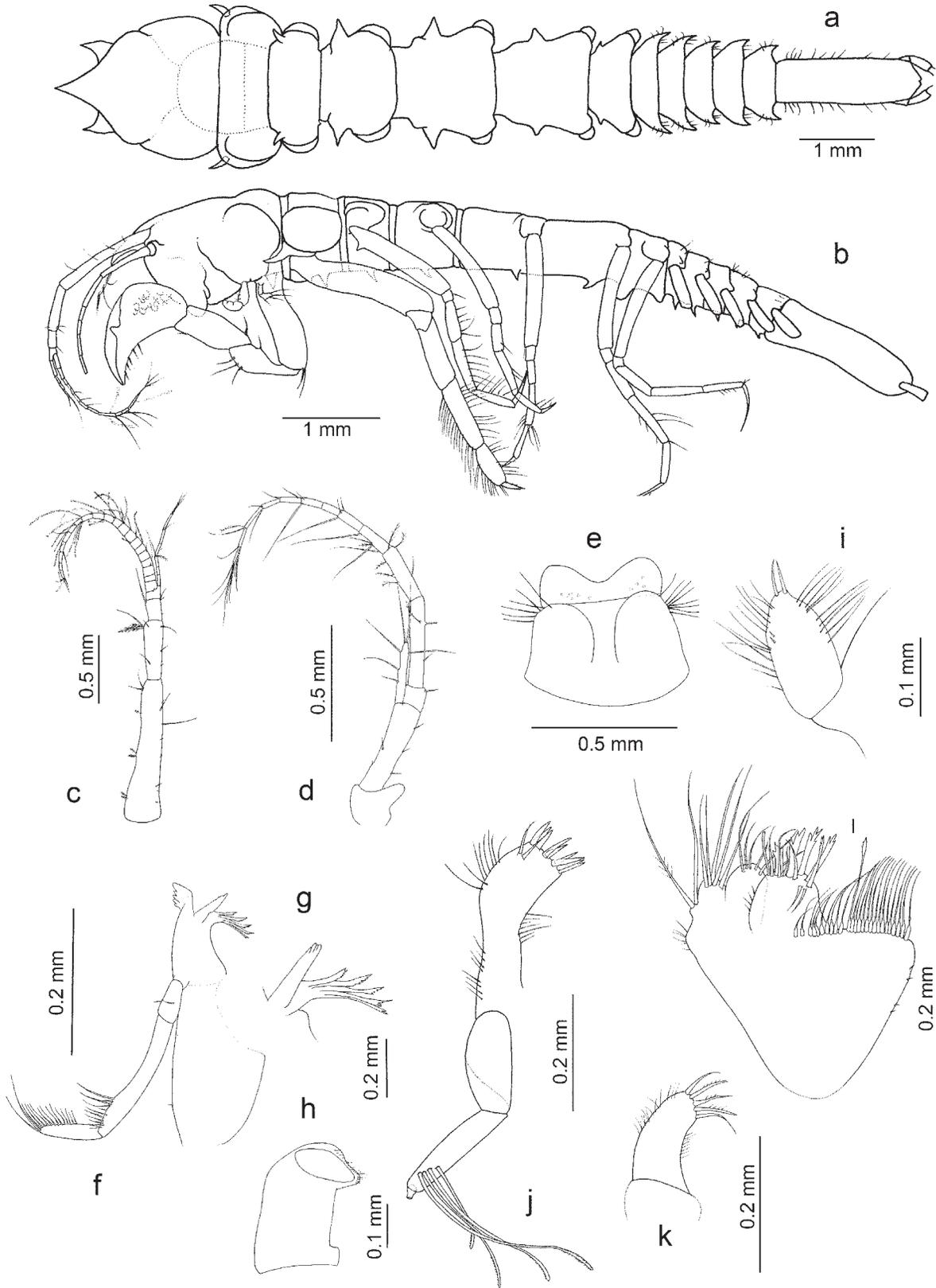


Figure 1.

Carpoapseudes heardi n. sp. (a) ovigerous female (11.2 mm) paratype dorsal view, (b) male holotype (8.3 mm) lateral view, (c) antennule, (d) antenna, (e) labrum, (f) left mandible, (g) same, spine row enlarged, (h) molar process, (i) labium, (j) maxillule palp and outer endite, (k) maxillule inner endite, and (l) maxilla.

stored in 70 % isopropyl alcohol. Samples were sorted and identified by Barry Vittor and Associates (BVA),

Mobile, Alabama. Slide mounted specimens were studied with a Leica MZ6 and illustrated with a Leitz camera luci-

da-equipped Nikon Optiphot. All measurements are given in millimeters. Types are deposited in the United States National Museum (USNM) in Washington, D.C. and additional material is retained at BVA. The terminology of Watling (1989) and Larsen (2003) is followed, with the exception that spiniform setae on the pereopod articles are called spines. The terms parallel and divergent are proposed for the orientation of the eye spines. Anteriorly directed eye spines, in relation to the carapace, are referred to here as parallel, whereas outward directed spines are divergent.

SYSTEMATIC ACCOUNT

Suborder Apseudomorpha Sieg, 1968

Family Apseudidae Leach, 1814

Subfamily Leviapseudinae Sieg, 1980

Genus *Carpoapseudes* Lang, 1968

Diagnosis (modified from Lang (1968), Guțu (1996) and Larsen (1999))

Carapace with rostrum and eye lobes bearing a terminal spine. Pereonites 3-5 with lateral spines; pereonite 6 shorter than pereonites 3-5, trapezoidal in shape. Pleotelson cylindrical and long. Antenna with 5-articled peduncle; squama well-developed. Mandible with 3-articled palp. Maxillule with 2-articled palp. Endite of maxilliped with a leaf-like spine. Chela and pereopod 1 with exopodites. Pereopod 1 coxa with spine. Pereopod 1 with carpus and propodus, dorsal and ventral margins lined with numerous finely attenuate setae. Chelipeds sexually dimorphic, with triangular tooth on fixed finger in males. Pleopods well-developed, five pairs.

Described species included in genus: *Carpoapseudes aurotochelis* Kudinova-Pasternak, 1975; *C. austroafricanus* (Barnard, 1940); *C. bacescui* Guțu, 1975; *C. caraspinosus* Dojiri and Sieg, 1997; *C. curticarpus* Băcescu, 1982; *C. kudinovae* Băcescu, 1981; *C. laubieri* Băcescu, 1982; *C. longissimus* Lang, 1968; *C. menziesi* Guțu, 1975; *C. oculicornutus* Lang, 1968; *C. prospectnes* Larsen, 1999; *C. romanae* Băcescu, 1987; *C. rotundirostris* Kudinova - Pasternak, 1989; *C. serratosipinosus* Lang, 1968; *C. simplicirostris* (Norman and Stebbing, 1886); *C. spinigena* Bamber, 2007; *C. varindex* Bamber, 2007.

Carpoapseudes heardi n. sp.

MATERIAL EXAMINED

Holotype (USMN 1110765) 8.3mm male, Offshore Tobago, Block 22, 30 November 2006, Station SLCA-MDFD-1, 11° 29'39.012" Latitude, 60° 37'57.1494" Longitude, 537 m, mud.

Paratypes

4 specimens (11.2, 10.5 mm ovigerous females, 10 mm male, 6.4 mm juvenile) Offshore Tobago, Block 22, 30 November 2006, Station SLCA-MDFD-1, 11° 29'39.012" Latitude, 60° 37'57.1494" Longitude, 537 m, mud. USMN 1110766 2 specimens (10.3 mm male, 8.5 mm female) Offshore Tobago, Block 22, 16 November 2006, Station ASC-

FRFD-6, 11° 29'50.3394" Latitude, 60° 47'56.3214" Longitude, 421 m, sandy mud. USMN 1110767

Diagnosis

Rostrum triangular, acuminate, extending beyond eye lobes, carapace without lateral apophyses. Eye lobes acuminate, anteriorly projecting. Epistome without spine. Labrum with two lobes on article 1. Male chela with ventral process on carpus. Pereonite 1 with bulbous expansion housing coxa. Pereonites 2 and 6 with small anterolateral spines. Pereopods 2 and 3, basis with dorsoproximal spur-like apophysis. Pleopods inserted midlaterally, bearing exopods, endopods 1-articulate. Female with five pairs of oostegites located on cheliped and pereopods 1-4.

Etymology

This species is named for our friend and tanaid expert, Richard W. Heard.

Description of male holotype (Figures 1-3)

Body (Figure 1b) 8.3 mm long, glabrous, white, iridescent, tapering posteriorly, with long, narrow pleotelson. Carapace about 0.9 times as long as wide, with slightly downturned, triangular rostrum extending about 1/3 length of antennular article 1, inflated branchial lobes lacking spines, delineated dorsally by shallow furrows. Pereonite 1 widest, with large bulbous lateral lobes surrounding coxa of pereopod 1. Pereonites 3-5 with strong lateral spines located slightly anterior to the midpoint of the somite. Pereonites 2 and 6 with smaller anterolateral spines. Pleonites with epimera bearing spines and short setae. Hyposphensia present between cheliped bases, on all pereonites and on pleonites 1-5. Genital cone broadly rounded. Pleopods inserted midlaterally.

Antennule (Figure 1c) with 4-articulate peduncle, article 1 longer than remaining three combined, with several broom setae on outer margin, two adjacent setae distally. Inner margin with two long and several short setae. Article 2, outer margin with cluster of setae and aesthetascs on distal third. Article 3 shorter than article 2, with long seta on outer distal margin and shorter paired setae on inner distal margin. Article 4 common with outer flagellum of 20 articles, with strap-like aesthetascs on inner margins of articles 4, 6, 8, 9, 10, 11-18, on outer margins of articles 11, 13, and 17. Single setae on outer margins of articles 5, 7 and 9. Tip of outer flagellum with four simple setae and one broom seta. Inner flagellum of six articles with single simple and broom seta on third article, two simple setae on fifth article, strap-like aesthetasc and three simple setae on terminal article.

Antenna (Figure 1d) with 5-articulate peduncle. Article 1 with broad inner lobe, article 2 with squama and three setae on outer margin, article 3 shortest, with single inner distal seta, articles 4-5 with several broom setae. Squama bearing five setae, with one on inner margin and four on outer margin. Flagellum 9-articulate, with 5 terminal setae. Articles 1, 2 and 4 with long outer seta, article 7 with broom setae.

Labrum (Figure 1e) with article 1 bearing two ventral

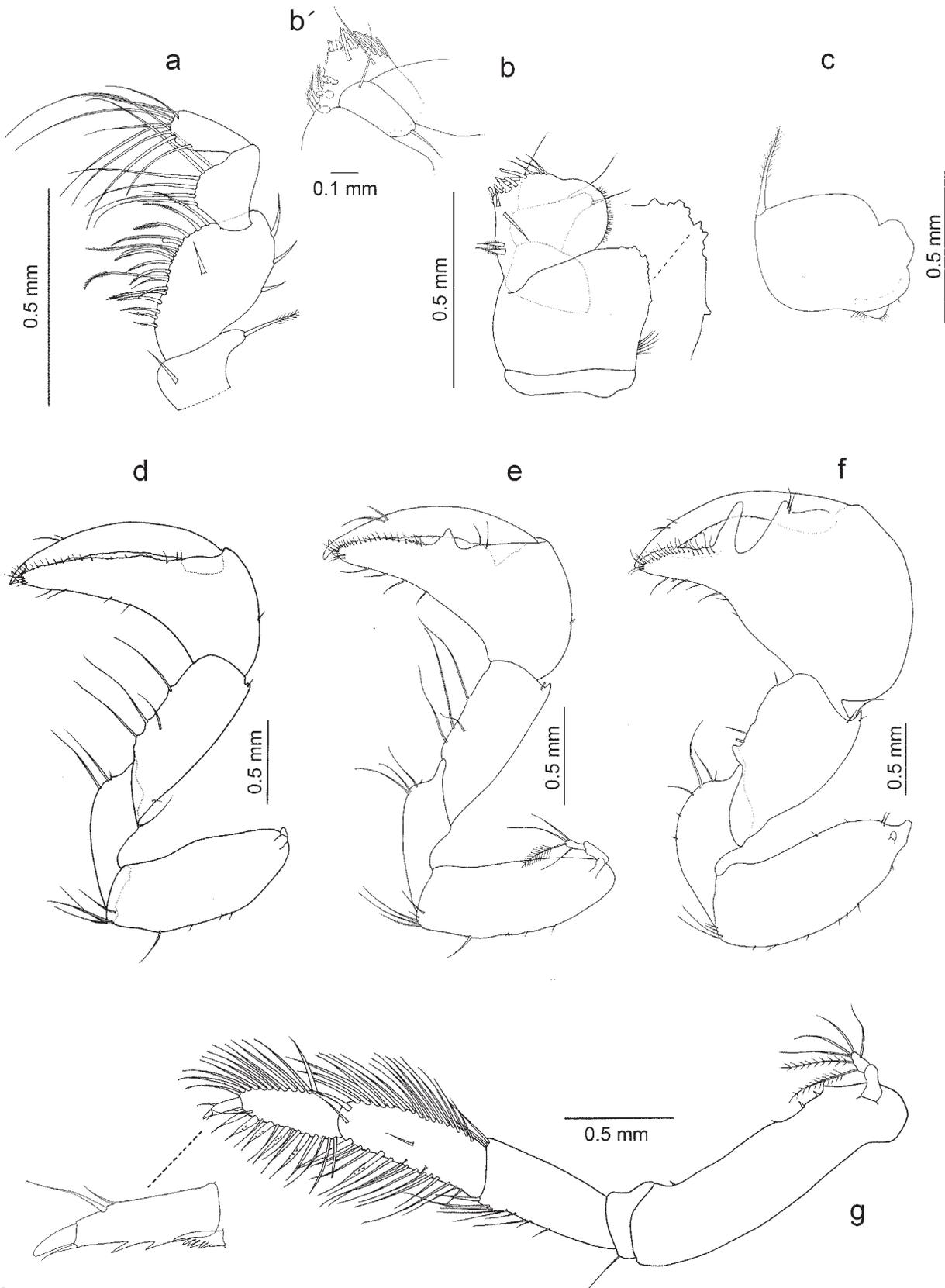


Figure 2.

Carpoapseudes heardi n. sp. (a) male holotype (8.3 mm) maxilliped palp, (b) male paratype (10 mm) maxilliped endite, (b') endite opposite, (c) epignath, (d) ovigerous female paratype (11.2 mm) cheliped, (e) cheliped, (f) male paratype (10 mm) cheliped, (g) pereopod 1.

lobes, each with long setal cluster on outer margin, article 2 with broadly excavate mid-margin.

Mandible (Figures 1f-h). Left mandible with broad molar

process bearing oval, smooth triturative surface with outer cusp and fine setules. *Pars incisiva* with five broad denticles. *Lacinia mobilis* narrow, with four denticles. Spine row con-

sisting of five setae, four with multifurcate tips, one with bifurcate tip. Palp 3-articulate, article 1 shortest, bearing two setae. Article 2 longer than articles 1 and 3 combined, distal inner margin bearing row of seven serrated setae, decreasing in length distally, with six smaller, curved, subequal setae. Article 3, distal two thirds bearing inner row of thirteen curved setae, distal margin bearing two longer setae. Right mandible not illustrated but similar to left.

Labium (Figure 1i). Basal endite not illustrated. Palp, margins with long setules, with two distal setae.

Maxillule (Figures 1j-k). Outer endite with nine distal spiniform setae, two subterminal setulate setae. Palp 2-articulate, distal article longer than proximal, bearing facial row of four elongate subterminal setae with serrated tips and single larger terminal spine (broken). Inner endite with five distal setae with fine setules on inner and outer margins

Maxilla (Figure 1l). Movable endite, outer lobe with seven setae, outermost pair setulate, inner lobe with five stout curved setae. Fixed endite, outer lobe with two subterminal setae, one palmate, three multifurcate setae, six setae with serrate tips. Inner lobe with comb row of about 25 curved, basally inflated setae, with one to two straight guard setae.

Maxilliped (Figures 2a-b, b'). Coxa very short, nearly as wide as basis. Basis large, quadrate, distal outer margin crenulate, sculptured. Palp article 1, outer lobe bearing large, distally setulate seta, inner margin with single simple seta. Article 2, outer margin bearing three stout curved setae, lateral surface with single seta, inner margin with two rows of setulate setae, dorsal row consisting of six short and single, atypical, thick, blunt seta, ventral row with eleven setae. Article 3 with six distally attenuate setae on inner margin. Article 4 with seven setae. Endite, inner margin serrate, with three coupling hooks, three circum-plumose setae. Inner surface with subterminal, apically inflated serrate spine ("leipid spine") and subterminal simple setae. Distal inner margin with five truncate setae, outermost seta distally setulate. Distal outer margin of endite with five setae, distally flattened.

Epignath (Figure 2c). Cup-shaped, with large setulate seta and two basal lobes.

Cheliped (Figures 2d-f). Basis short, bearing 2-articulate exopod, article 2 with four plumose setae. Ventral margin of basis without spine, with five ventrodiscal setae. Merus with three ventrodiscal setae and short spine. Carpus, ventral margin with three long and one short seta, dorsodiscal margin with spinous apophysis and single strong seta (broken). Propodus, fixed finger with ventral margin bearing four short setae, distal margin with small setae and claw, setal row extending onto cutting surface, triangular tooth on cutting margin followed by row of short spines. Dactylus, cutting margin bearing short spines, dorsal margin with two setae.

Pereopod 1 (Figure 2g). Coxal process bulbous, as long as pereonite 1, with anterolaterally directed spine. Basis 3.7 times longer than wide, with 2-articulate exopod, article 2

with five plumose setae (illustrated for 2 setae). Dorsoproximal margin of basis with apophysis and short setae. Ischium with ventral seta. Merus about 4/5 length of carpus, ventrodiscal margin with eight setae, one stronger spine, dorsodiscal margin with two setae. Carpus, both margins lined with row of long attenuate setae, ventrodiscal margin with two spinulate spines. Propodus about 2/3 length of carpus, dorsal margin with eleven attenuate setae, ventral margin with six antennulate setae, seven spinulate spines, and single short distal spine bearing seven ventral denticles. Dactylus plus unguis short, 1/3 length of propodus. Dactylus, ventral margin with two spines, one distal seta, dorsodiscal margin with two setae. Unguis thick, shorter than dactylus.

Pereopod 2 (Figure 3a). Basis with spur on dorsoproximal margin, numerous short setae on both margins. Ischium with ventrodiscal seta (broken). Merus shorter than carpus, with six ventral and three dorsal setae. Carpus with ventral margin with nine long attenuate setae and dorsodiscal margin with distal cluster of four setae. Lateral surface of carpus with six setae with raised bases. Propodus shorter than carpus, with ventral row of six setae and short distal spine. Propodal spine with six teeth on ventral margin and with fine dorsal denticles. Distal half of dorsal margin of propodus with closely spaced row of eight long, attenuate setae. Dactylus about 1/2 length of propodus, with single dorsal and ventral setae. Unguis broken.

Pereopod 3 (Figure 3b). Basis with dorsoproximal spur, longer than combined length of ischium, merus and carpus. Ischium short, with dorsodiscal broom seta. Merus shorter than carpus, with few setae. Carpus similar to pereopod 2, but without row of lateral setae, ventral margin with six setae, one ventrodiscal spine. Propodus with setae and broom seta on dorsodiscal half. Ventral margin of propodus with five setae and short distal spine with three ventral teeth. Unguis plus dactylus slightly longer than propodus. Dactylus with one ventral fixed spine and three dorsal setae. Unguis slightly shorter than dactylus, weakly curved.

Pereopod 4 (Figure 3c). Basis like pereopod 3, but without spur and with constriction near middle (artifact?) with strong ventrodiscal seta (broken). Ischium with two ventrodiscal setae. Merus about 1/2 length of carpus with single dorsodiscal and three ventrodiscal setae. Carpus longer than all other articles except basis, with lateral oblique row of seven setae on distal margin and with four setae on ventral margin. Propodus with dorsoproximal broom seta, distal margin truncate, bearing five attenuated setae. Ventral margin with three setae. Dactylus plus unguis shorter than that of pereopod 3, about 2/3 length of propodus. Dactylus longer than unguis, dorsal margin with two setae, ventral margin with one distal seta.

Pereopod 5 (Figure 3d). Basis bearing large mid-dorsal broom seta, two ventrodiscal setae. Ischium similar to pereopod 2. Merus shorter than carpus, with single ventrodiscal and dorsodiscal setae. Carpus with single strong ventrodiscal

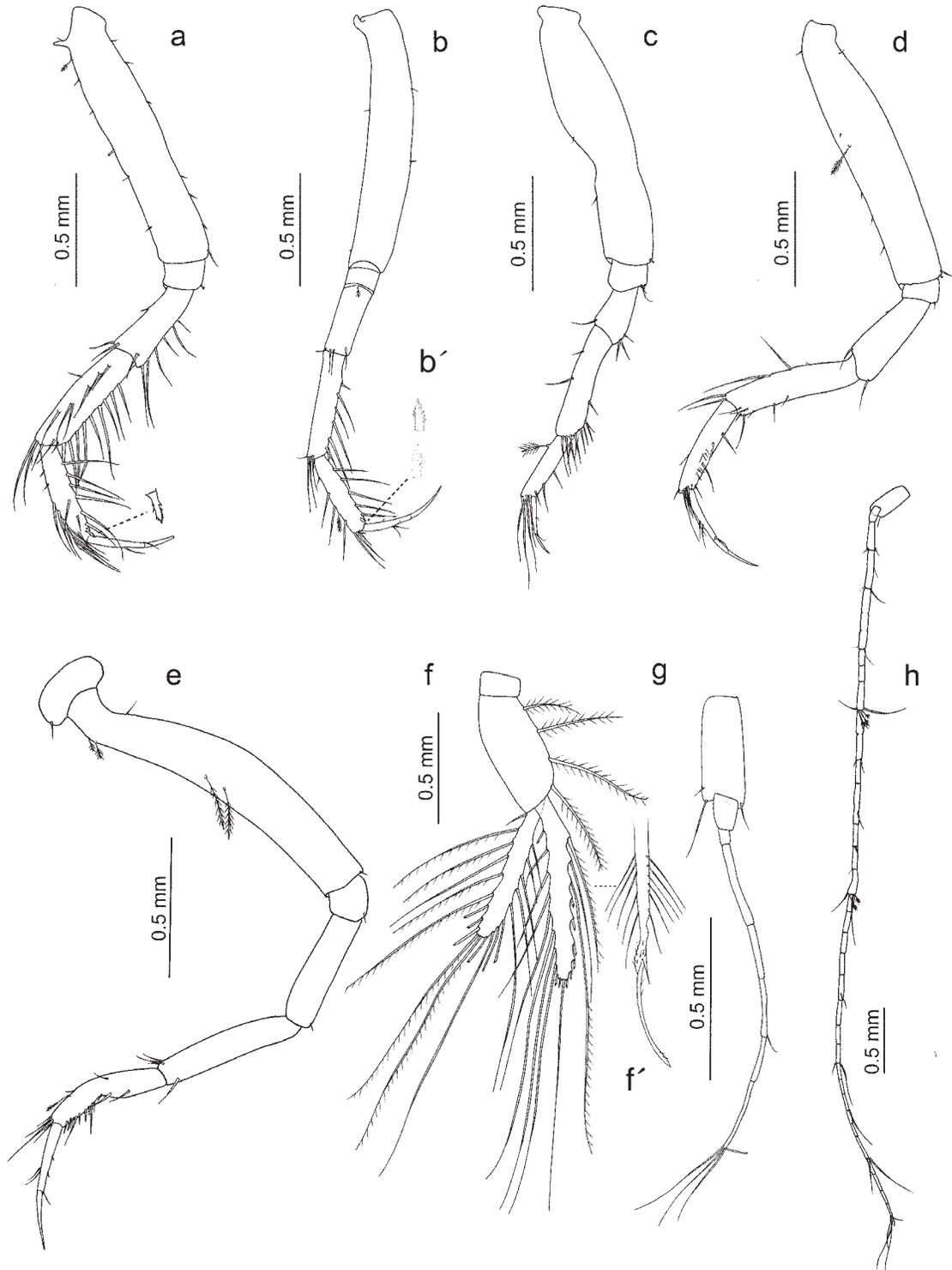


Figure 3.

Carpoapseudes heardi n. sp. (a) male holotype (8.3 mm) pereopod 2 with enlarged spine, (b) pereopod 3 with enlarged spine, (b') ovigerous female paratype (11.2 mm) pereopod 3 spine, (c) pereopod 4, (d) pereopod 5, (e) pereopod 6, (f) pleopod 1, (f') male paratype (10 mm) pleopod endopod specialized seta, (g) female paratype uropodal exopod, and (h) male paratype endopod.

seta and four weaker setae. Dorsal margin of carpus with four attenuated setae on distal half. Mesiodistal margin of carpus with two setae. Propodus about equal to length of merus, with ventrolateral row of six spines on inner margin.

Mesiodistal margin of propodus with four setae. Ventral margin of propodus with four setae. Dactylus plus unguis equal to length of propodus. Dactylus, with two dorsal and single ventral setae. Unguis slightly shorter than dactylus.

Pereopod 6 (Figure 3e). Coxa toroidal-shaped, distal margin bearing single seta. Basis with two large middorsal broom setae with smaller and distal broom setae present. Ischium with single ventrodorsal seta. Merus with ventrodorsal seta. Carpus longer than merus, with few setae. Propodus with midventral indentation (artifact?), 10 spines, two setae. Dorsal margin with broom seta on distal third, with five distal setae. Dactylus plus unguis longer than propodus. Ventral margin of dactylus with four setae and dorsal margin with two setae. Unguis shorter than dactylus.

Pleopod (Figures 3f,f'). Peduncle 2-articled, article 1 short, naked, rectangular, article 2 with four plumose setae on inner margin. Endopod slightly longer than exopod, 1-articled, margins lined with 20 or more long plumose setae. First proximal seta of inner margin of endopod highly modified (Figure 3f). Exopod 1-articulate, margins bearing about 20 plumose setae.

Uropod (Figures 3g-h). Protopod attached near dorsal margin of pleotelson, dorsal margin with two distal setae, ventral margin with single distal seta. Exopod with seven articles, including three pseudosegments, bearing one seta on article 5. Tip with four setae. Endopod with 33 articles, including about three pseudosegments. Articles 2, 4, 7-12, 16, 19, 27, and 26 with setae, usually paired. Articles 7 and 13 with 2-3 broom setae. Tip with five setae.

Sexual and developmental differences

Females are similar to males in dorsal view (Figure 1a). Cheliped merus of female has two ventrodorsal setae (Figure 2d). Large males have a tubercle on the ventroproximal margin of the carpus of the cheliped that is absent in younger males and all females (Figure 2f). Propodus of largest males has more setae on the ventral margin of the fixed finger. The large propodal tooth on the cheliped fixed finger is absent in the female. The female cheliped of the *C. heardi* n. sp. lacks the propodal tooth although this is prominent in the younger and older males. In the largest adult males, a second smaller cheliped tooth is also found near the articulation with the dactylus (Figure 2f). Large males have proportionally short exopods on the chela when compared to the length of the basis. In the ovigerous female pereopod 3 has a short propodal spine bearing smaller denticles. Hypo-sphenial spines are stronger in the large adults. Numerous aesthetascs, strap-like in shape, are also found on the male outer antennular flagellum, although these are absent in the female. With regards to the base of the maxilliped, the outer margin of article 2 of mature *C. heardi* n. sp. has strong crenulations as also illustrated for *C. auritochelis* Kudinova-Pasternak, 1975. These and the size of the cheliped propodal triangular tooth are likely related to the maturity of the tanaid.

Ovigerous females with a marsupium have five pairs of oostegites present including one on the cheliped and one on pereopods 1-4. Large males also have five plumose setae on the inner margin of the protopodite of the pleopod rather than four. The highly modified seta on the endopod of the pleopod

also seems to be found only in mature individuals (Figure 3f').

DISCUSSION

Carpopseudes heardi n. sp. differs from all other known species in the genus by a combination of characters, the prominent being presence of parallel eyespines and the lack of an epistomal spine. *Carpopseudes bacescui* Guțu, 1975 and *C. simplicirostris* (Norman and Stebbing, 1886) also have parallel or anteriorly directed eyespines plus epistomal spines. *Carpopseudes heardi* n. sp. further differs from these two species by the presence of a larger rostrum. In *C. simplicirostris* the rostrum is very narrowed and stick-like while the rostrum of *C. bacescui* is shorter than that of *C. heardi* n. sp. Like *C. heardi* n. sp., *C. longissimus* Lang, 1968 and *C. oculicornutus* Lang, 1968 lack epistomal spines, but they differ from the new species by having divergent rather than parallel eyespines. A comparison of the first pereopod of *C. heardi* n. sp. to other related species reveals that this leg has a shortened dactylus similar to that of *C. serratospinosus* Lang, 1968, but the merus of *C. heardi* n. sp. lacks the dorsal setae as characteristic of the former species.

Carpopseudes prospectnes Larsen, 1999 which was described from Brazilian waters and is the only other member of the genus known from the western Atlantic, is distinguished from *C. heardi* n. sp. by the having an epistomal spine and lacking parallel eyespines. With the description of *C. heardi* n. sp. the genus *Carpopseudes* now contains 18 species, most of which are reported from depths greater than 1000 m. Three species of *Carpopseudes*, *C. heardi*, n. sp., *C. prospectnes*, and *C. serratospinosus* however, are known from depths < 900 m, with *C. prospectnes* having the shallowest occurrence (295-360 m).

An examination of the mouthparts of the new species reveals that the inner distal seta on the maxilliped endite of *C. heardi* n. sp. is long, serrated, and not leaf-like, but can be considered a "leiopid spine" based on its size and position, indicating a relationship with *Leviapseudes* Sieg, 1983 and related genera. The labial palp of *C. heardi* n. sp. has two terminal spines as in *C. spinigena* Bamber, 2007 and *C. prospectnes* whereas three spines are present in most other species. The mandibular palp of the new species has an interesting arrangement of setae on the second article of the palp, with the setae steadily decreasing in size distally on the article.

The shape of the pereopod 3 propodal spine of *C. heardi* n. sp., with regards to the size and number of ventral denticles, also varies between the sexes. Females have smaller and more numerous ventral denticles than males (Figure 3b').

The number of oostegites present in members of *Carpopseudes* is controversial. Guțu (1981) and Dojiri and Sieg (1997) reported that the genus *Carpopseudes* had five pairs of oostegites; however, Larsen (1999) reported only 4 pairs. It is possible that some authors did not have fully ovigerous female material available to study. Based on our observations, the cheliped oostegite of *C. heardi* n.

sp. does not form until the marsupium is present. For instance, one ovigerous female (11.2 mm; Figure 1a) did not have a cheliped oostegite whereas another (10.5 mm) had a fully formed marsupium with the cheliped oostegite. Finally, on *C. heardi* n. sp. the oostegite forms posterior and

medial to the insertion of the cheliped and not near the exopod as in other apseudid genera examined by the authors.

Like most species of the genus, *C. heardi* n. sp. has simple non-plumose setae of the lateral epimera of the pleonites; in contrast, *C. bacescui* Guțu, 1975 has long plumose setae.

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