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HAUSTORIUS JAYNEAE, A NEW SPECIES OF HAUSTORIID AMPHIPOD FROM THE NORTHERN GULF OF MEXICO, WITH NOTES ON ITS ECOLOGY AT PANAMA CITY BEACH, FLORIDA U.S.A.

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ABSTRACT A new species of sand-burrowing amphipod, Haustorius jayneae, is described from the swash zone and shallow subtidal sands along the north Florida and Mississippi Gulf coasts. It is most similar to H. canadensis from the American Atlantic coast, differing primarily in the presence of a distinct antero-distal spinous lobe on pereopod 6, article 5; a longer row of distal marginal spines on pereopod 7, article 4; and fewer proximal spines on the peduncle of uropod 1. A revised key to the known species of Haustorius is included and information on the ecology of H. jayneae n. sp. at Panama City Beach, Florida, is reviewed.

INTRODUCTION

Taxonomic and zoogeographic studies of Gulf of Mexico Haustoriidae are scarce. A lack of keys for Gulf material, a reflection of the underdeveloped state of knowledge about the family in the region, has limited workers to the use of keys and guides written primarily for Atlantic coast material. As a result, government and private environmental assessment reports often provide few species lists in which citations are limited to genera, or where species are listed which do not occur in the Gulf of Mexico.

Existing knowledge of the Gulf Haustoriidae is reported primarily in papers which describe new species (Pearse, 1908; Robertson and Shelton, 1978; Robertson and Shelton, 1980; Thomas and Barnard, 1984; Foster, 1989) and in several ecological papers which have reported undescribed species and recognized them as such (Thomas, 1976; Shelton and Robertson, 1981). Foster (1989) reviewed the history of haustoriid studies in the Gulf and listed the known species.

Among the numerous taxonomic problems associated with the Haustoriidae, questions concerning the type genus Haustorius Muller, 1775 are particularly significant. Three species are currently recognized in the genus. The type species, Haustorius arenarius (Slabber, 1769), is distributed in the northeastern Atlantic and has also been reported from the Gulf of Mexico (Pearse, 1912), although Croker (1967) considered such early records to be the result of erroneous identifications. The remaining two species, Haustorius canadensis Bousfield, 1962 and Haustorius algeriensis Mulot, 1967, are distributed in the northwestern Atlantic and along the North African coast in the Mediterranean Sea, respectively.

Five additional haustoriid species originally assigned to the genus Haustorius have since been placed in other genera. These include the Gulf of Mexico species Pseudohaustorius americanus (Pearse, 1908) and the North Atlantic species Acanthohaustorius spinosus (Bousfield, 1962), both removed from Haustorius by Bousfield (1965). In addition, the northern Pacific species Eohaustorius washingtonianus (Thorsteinson, 1941), E. eous (Gurjanova, 1951), and E. chelifereus (Bulycheva, 1952) were removed from Haustorius by Barnard (1957).

A number of undescribed haustoriid species are known to occur in the Gulf of Mexico. Bousfield (1970) indicated that at least ten undescribed species of Haustoriidae occur in the region, although the number of species in the type genus was not reported. In addition, recent studies have resulted in the reporting of a "longrostrale" Haustorius species from North Carolina (Bousfield, 1965; Fox and Bynum, 1975). Although no formal description was published, this form is included in the key provided in this paper.

Ecological reports with reference to Haustorius in the northern Gulf of Mexico are numerous. For example, in the area between Cape San Blas, in the Florida Panhandle, and Mississippi Sound, the genus has been reported by Saloman (1976), Saloman and Naughton (1977; 1978), Saloman et al. (1982), Taylor (1987), and Heard and Stuck (1988). Thomas (1976) also reported an undescribed species of Haustorius from Barataria Bay, Louisiana, occurring in fine sand from the drift line to a depth of 1-2 meters, and Robertson and Shelton (1980) found an undescribed species in a similar habitat on the Texas coast.

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METHODS

Material for this study came from several locations along the coasts of Florida and Mississippi. These include St. Andrew Bay, Panama City Beach, Cape San Blas, and Perdido Key, Florida, as well as Horn and Ship Islands, Mississippi. In all localities, amphipods were collected in the swash zone and from tidal pools with suction devices (yabby pumps), push nets, or coring tools. See Saloman (1976) and Heard and Stuck (1988) for detailed information on localities, methodology, sedimentology, and associated fauna.

Margins of the antennae and uropods are referred to as dorsal and ventral in the text, as opposed to anterior and posterior, because of their orientation along the main axis of the body.

Haustoriidae Stebbing, 1906
Haustorinae Bousfield, 1965
Haustorius Muller, 1775
Haustorius jayneae, new species

Diagnosis

Antenna 1, accessory flagellum 4-5 segmented. Rostrum short, subacute, wide at base, not exceeding midpoint of antenna 1, peduncle 1. Pereopod 5, article 6, anterior margin with 3-4 spine groups. Pereopod 6, article 4, posterior margin markedly oblique proximally, bearing 3-4 spines distally; article 5 subquadrate with distinct anterodistal spinous lobe. Pereopod 7, coxal plate with setae on posterodistal margin only; article 4, posterior margin markedly oblique proximally, bearing 3-4 spines distally; article 5 subquadrate with distinct anterodistal spinous lobe. Pereopod 8, article 7, posterior margin with 1 spine group, distolateral margin with a row of plumose setae interspersed with one-third distance to base.

Description

Paratype male SAB-f, 6.0 mm, Panama City Beach, Florida

Head - Broadest medially, rostrum blunt, wide at base; slightly exceeding anterolateral apices, extending one-quarter of dorsally visible length of antenna 1, peduncle 1; antennal sinuses markedly convavo.

Antenna 1 - Peduncle article 1 and 2 subequal, article 3 two-thirds length of article 2; peduncle 1, dorsolateral margin lined with plumose setae, ventrolateral margin with 4 pilose spines; peduncle 2 widened distally, dorsal margin with a row of plumose setae interspersed with shorter simple setae, lateral surface with mixed plumose...
A NEW HAUSTORIID AMPHIPOD FROM THE GULF OF MEXICO

Figure 1. *Haustorius jayneae* n. sp. Lateral view of adult female (6.0 mm) from St. Andrews Bay, Florida. Scale = 1.0 mm.

and simple setae; peduncle 3, ventral margin with row of long pilose spines inserted near articulation with flagellum; flagellum with 9 articles, each with short simple setae inserted terminally, several with aesthetascs; accessory flagellum 4 segmented.

**Antenna 2** - Peduncle 4 expanded ventrally to form deep lobe with broadly rounded distal projection, ventral margin with 22 spines inserted laterally and a row of densely plumose setae inserted medially along margin, 5 plumose spines on proximal half of ventral margin, lateral surface with row of 5 setae near proximal dorsal margin, medial surface with oblique row of 6 setae across width of article, dorsal margin with distolateral row of plumose setae, ventral margin with 2-3 thin pilose spines distally in sinus formed by distal lobe of article; article 5 slightly over half length of article 4, with strongly convex ventral lobe, ventral margin lined with long plumose setae, distoventral corner with cluster of plumose, several thin spine-like setae and 1 thick pilose spine, distolateral margin with row of thinner, shorter plumose setae and scattered slender, simple setae; distal half of dorsal margin with row of plumose setae; flagellum of 10 articles, article 1 longest, with distoventral row of plumose setae, article 2 half length of article 1 and bearing 1 distoventral plumose seta, article 3 with 1 distoventral plumose seta, remaining articles with groups of simple terminal setae.

**Upper Lip** - Broad, apex flattened, corners abruptly rounded.

**Lower Lip** - Inner lobes extending two-thirds length of outer lobes, truncate distally and finely pilose; outer lobes broadly rounded, pilose around margins, both lobes with numerous short spines along inner distal margin.

**Mandible** - Right side, incisor bifid, raker row of 10 distally serrate blades; molar triturative with 1 projecting plumose seta; palp article 2 with marginal and facial row of short simple setae, article 3 with 17 pectinate spines in comb row, 14 - 15 distally tapered, minutely pectinate terminal spines. Left side, lacinia mobilis short, conical.

**Maxilla 1** - Inner plate with 10 sparsely plumose marginal setae; outer plate with 4 stout, smooth, blunt and 12 slender, minutely serrate, subacute distal spines; palp article 2 with marginal and apical plumose setae, and tapered terminal spines with recurved tips; bailer lobe large and densely setose.

**Maxilla 2** - Inner plate linguiform, slender, with plumose marginal setae and oblique row of plumose facial setae; outer plate large, lunate, outer margin lined with fine setae, 14 stout, distally tapered comb spines mediially, inner margin with 30 - 32 sparsely plumose setae distally, lined with minutely plumose setae proximally.

**Maxilliped** - Inner plate with 11 inner marginal setae, proximal setae short and finely pectinate on both edges, distal setae longer, plumose, apical margin with 2 blunt, stout spines, aboral surface with 2 penicillate setae and a row of distal spines, oral surface with transverse row
of distal spines; outer plate slightly broader than inner with 12 recurved spines and numerous transverse rows of setae; palp article 3 with expanded distally, dense transverse rows of setae on inner margin, article 3 geniculate with long serrate setae and simple setae on distal margin, 9 elongate spines terminally, aboral surface with central row of simple setae.

**Coxal Plates** - Plates 1-4 increasing in size with each successive plate, combined ventral margins forming a gentle curve.

**Gnathopod 1** - Coxa deeper than wide, gently concave posteriorly with 6 plumose posterior marginal setae, posteroventral angle with 3 long, plumose setae, antero-distal margin with a row of simple setae, increasing in length distally; article 2 narrowed proximally with long, widely spaced simple setae on posterior margin; article 5, posterior margin with dense clusters of long simple setae along lateral and medial surfaces; article 6 one-half length of article 5, anterodistal margin with 6 - 7 transverse rows of long, distally recurved, finely pectinate setae, posterodistal margin with 5 row of shorter, distally recurved, finely pectinate setae, posterodistal margin with 5 rows of distally recurved, finely pectinate setae; article 7 one-quarter length of article 6, projecting nail subequal in length to article 7.

Figure 2. *Haustorius jayneae* n. sp., paratype male SAB-f (6.0 mm): (A) mandible; (B) maxilla 1; (C) maxilla 2; (E) lower lip. Adult male (6.0 mm), St. Andrew Bay, Florida: (D) maxilliped. Scales: a = 0.2 mm (B-C, E); b = 0.2 mm (A); c = 0.4 mm (D).
Figure 3. *Hanstorius jayneae* n. sp., paratype male SAB-f (6.0 mm): (A) antenna 1; (B) antenna 2; (C) gnathopod 1; (D) gnathopod 2; (E) pereopod 3; (F) pereopod 4; (G) spatulate comb spine from gnathopod 2, article 5. Scales: a = 0.5 mm (E-F); b = 0.5 mm (A-D), 0.08 mm (G).
Figure 4. *Haustorius jayneae* n. sp., paratype male SAB-f (6.0 mm): (A) pereopod 5; (B) pereopod 6; (C) pereopod 7; (D) telson; (E) uropod 3; (F) uropod 2; (G) uropod 1. Scales: \( a = 0.5 \text{ mm} \) (A-C); \( b = 0.2 \text{ mm} \) (D), \( 0.4 \text{ mm} \) (E-G).
Gnathopod 2 - Coxa deeper than wide, anterior margin convex, posterior margin nearly straight, with 6 plumose setae distally, anterodistal margin with 6 simple setae; article 2 slightly narrowed proximally with row of evenly spaced clusters of long simple setae on posterior margin; article 5, anterior margin with evenly spaced groups of minutely pectinate setae, outer lateral surface with scattered simple setae, anterodistal margin with cluster of 5 minutely pectinate setae, posterior margin with 3 - 5 groups of medially inserted, spatulate comb spines on distal half, row of simple setae along entire margin; article 6, anterior margin with 6 - 7 transverse rows of long, distally recurved, minutely pectinate setae, anterodistal margin with a row of 6 spines, lateral distomedial margin with 2 spines, anterodistal angle with cluster of 5 spines, proximal margin with row of 6 spines extending about one-quarter length of margin, center distomedial margin with a group of 2 spines, posterior distomedial margin with row of 4 spines, posterior margin with 4 stout spines and a row of plumose setae, proximal section of margin narrowing abruptly, lateral surface with clusters of 2 - 4 spines; article 5 subquadrate, slightly wider than long with defining lobe at anterodistal angle, anterior margin with 3 groups of 3 - 6 spines, anterodistal lobe with 5 spines, distal margin with central row of 12 spines, posterodistal angle with cluster of 4 spines, posterior margin with 3 spines, lateral surface with 5 groups of 1 - 3 spines, article 6 naked anteriorly, posterior margin with 5 groups of 2 - 5 spines, terminal spines 10.

Pereopod 4 - Coxa small, posterior lobe subacute, with simple setae on distal margin; article 2 ovate, with a cluster of proximal plumose facial setae, anterior margin lined with plumose setae on distal margin, proximal margin with 4 distally tapered pectinate setae, anterodistal angle with 9 pectinate setae, posterior margin with scattered short setules, or bare; article 4 much broader than long, proximal and distal margins nearly parallel posteriorly, widening anteriorly, anterior margin twice length of posterior with 2 groups of 2 - 4 spines, anterodistal angle with 8 spines, proximal margin lined with plumose setae, posterior margin with cluster of 1 long and 2 short stout spines, 1 long plumose setae (broken off), 5 pectinate setae, posterodistal angle with 1 stout spine, distomedial margin with row of 16 spines, distolateral margin with row of 10 spines extending over half the length of distal
margin, lateral and medial surfaces with scattered clusters of long setae; article 6, posterior margin with distal cluster of 2 stout spines and 1 pectinate seta, posterodistal angle with 2 short lateral spines. row of 4 longer medial spines, cluster of simple setae on medial margin, posterior facial spines 2, anterior marginal spines in 6 groups of 5 - 7 spines each, medial surface with oblique row of 4 spines near anterodistal margin, lateral and medial surfaces with numerous clusters of simple setae; article 6 anterior marginal spines in 3 groups of 2 - 4 spines each, posterior marginal spines in 4 groups of 1 - 4 spines each, medial surface with 1 group of 3 spines, lateral surface with 1 group of 2 spines, terminal spines 7.

Pleopods - Pleopod 1, outer ramus with 15 segments, inner with 12; pleopod 2, outer ramus with 17 segments, inner with 12; pleopod 3 outer ramus with 16 segments, inner with 13.

Pleosome - With characteristics of the genus.

Uropod 1 - Ventromedial margin of peduncle with 2 clusters of simple setae, dorsal margin with 1 simple seta and 1 stout spine proximally, 3 stout spines distally, interramal area with 3 spines; outer ramus shorter than inner with lateral spine groups 2-2-3-4, medial surface with 5 groups of long simple setae, increasing in number distally, terminal spines 6; inner ramus, ventrolateral marginal spines on distal half in 2 groups of 3 - 7 spines each, dorsal margin with 4 groups of simple setae, terminal spines 9.

Uropod 2 - Dorsolateral margin of peduncle with a row of slender spines of varying lengths interspersed with long simple setae, dorsomedial margin of peduncle with distal cluster of long plumose setae; outer ramus slightly longer than inner, lateral surface with 3 clusters of long simple setae, terminal group of long setae; inner ramus similar.

Uropod 3 - Peduncle with 9 (5 medial, 4 lateral) spines; rami subequal, inner ramus with distal group of 3 spines on medial margin, 2 groups of long simple setae on lateral margin, terminally with 5 spines, numerous long, simple setae, 1 plumed seta; outer ramus 2-segmented, proximal segment with 2 dorsomarginal and 1 dorsoventral long setae, distoventral spines, distal segment slightly shorter than proximal segment, thinner, with 7 terminal spines, numerous long simple setae.

Telson - Cleft one-third distance to base, lobes subrectangular with small proximolateral lobes bearing 3 spines, distal margin with 9 spines, submarginal cluster with 6 spines, dorsal surface with 1 long and 1 short penicillate seta on each lobe.

Holotype Female SAB-e, 6.0 mm, St. Andrew Bay, Florida

Similar to male except for the following:

Oostegites - Slender, increasing in length posteriorly on pereopods 2 - 4, very small on pereopod 5, marginal setae elongate, simple.

Distribution

Haustorius jayneae occurs along sand beaches from Cape San Blas, Florida (Gulf County) to Mississippi Sound. It inhabits tidal pools and the swash zone seaward to a depth of two meters; however, most individuals occur in depths less than one foot.

Ecology

At Panama City Beach, Florida, monthly densities of Haustorius jayneae and its distribution across the nearshore zone were studied for a period of years by Saloman (1976) and Saloman and Naughton (1977;1978;1984). The swash zone population was shown to be the greatest in March and April of 1974-1975 with similar peaks during May and June of 1976. In a series of stations, beginning in the swash zone, extending through a series of sand bars, and terminating at a depth of 9.1 meters, H. jayneae occurred primarily in the swash zone and on the first sand bar (5.5% and 8.8% of all organisms collected, respectively). No specimens were recovered from the 9.1 meter station. This conforms to the pattern observed by Sameoto (1969) for H. canaden-sis at Sippewissett, Massachusetts, in that greatest densities are found in areas of complete saturation at low tide, such as sand bars. Juveniles were present during all months and ovigerous females were present in all samples examined except those from January and May.

The study area displayed an annual temperature variation of 19.0 to 32.1 °C and had an average salinity of 31.8 ppt. The sediments consisted of 99-100% quartz sand (Saloman, 1976). During a later nine month study in the same area, H. jayneae comprised 16.5% of the total population of organisms recovered from the swash zone, 55% of the Crustacea and 99% of the Amphipoda. At the first sand bar, H. jayneae comprised 34.1% of all organisms, 47% of Crustacea, and 93% of Amphipoda. May and June were peak population periods (Saloman and Naughton, 1984).

Saloman et al. (1982) investigated the macroinfauna of vegetated and unvegetated sediments within St. Andrew Bay and reported an undescribed Haustorius from four localities. While those specimens were not available for study, one of the stations conformed to the type locality of H. jayneae. The locality, at West Pass of St. Andrew Bay, was unvegetated 100% sand.

Etymology

This species is named in honor of Jayne E. Foster, whose patience and support for this project are greatly appreciated.

Variation

Within the samples examined from four locations on the northern Gulf coast, H. jayneae showed minor intra-
specific variation (Table 1). Minor variations were observed in the number of accessory flagellum segments, spination of the pereopods, and the spination of the dorsolateral margin of the peduncle of uropod 1. There was also a trend toward an increase in the number of spines in all areas with increasing animal size. This variability is to be expected in highly spinous fossorial forms such as the Haustoriidae (Thomas and Barnard, 1984).

Remarks

*Haustorius jayneae* is most closely related to *H. canadenis* Bousfield, 1962 from the American Atlantic coast. Major morphological differences between it and other known species are shown in the key and in Tables 2 and 3.

**KEY TO THE KNOWN SPECIES OF HAUSTORIUS**
(Modified from Bousfield, 1973)

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**TABLE 1**

Intraspecific Variation in Selected Characters of *Haustorius jayneae*

| Character | 4.0–5.0mm | 5.1–6.0mm | 6.1–8.0mm | 8.41–10.0mm | Overall Range |
|-----------|-----------|-----------|-----------|-------------|--------------|
|           | Range (Mean) | Range (Mean) | Range (Mean) | Range (Mean) | Overall Range |
| Antenna 1, # accessory flagellum segments | 4 | 4 | 4–5 | 4–5* | 4–5 |
| Mandible palp 3, # comb spines | 11–17 (13.0) | 12–20 (16.1) | 16–20 (16.6) | 22–23 (22.5) | 12–23 |
| Pereopod 5, article 4, # posterodistal spines | 5 (5.0) | 5–8 (6.4) | 5–9 (6.8) | 6–7 (6.5) | 5–9 |
| Pereopod 5, article 6, # anterior marginal spine groups | 3 (3.0) | 3 (3.0) | 3–4** (3.3) | 3 (3.0) | 3–4 |
| Pereopod 6, article 4, # posterodistal spines | 5–6 (5.3) | 4–8 (6.3) | 6–9 (7.6) | 6–10 (8.0) | 4–10 |
| Pereopod 7, article 4, # long medial posterior marginal spines | 6–8 (6.8) | 6–11 (8.6) | 9–18 (12.0) | 9–10 (9.5) | 6–18 |
| Pereopod 7, article 5, # anterior marginal spine groups | 6 (6.0) | 6–7 (6.3) | 6–7 (6.4) | 7 (7.0) | 6–7 |

* Two specimens, MISS-b and MISS-c had 5 segments
** One specimen, PK-f had 4 groups
TABLE 2
Comparison of Haustorius jayneae and Haustorius canadensis

| Character                  | H. canadensis                                                                 | H. jayneae                                                                 |
|----------------------------|-----------------------------------------------------------------------------|---------------------------------------------------------------------------|
| Rostrum                    | Acute, less broad basally                                                   | Subacute, triangular, wide at base                                          |
| Pereopod 5, article 6      | 4–5 anterior marginal spine groups                                          | 3, occasionally 4 spine groups                                             |
| Pereopod 6, article 4      | Long posterior margin before proximal narrowing, 6 posterior spines         | Shorter posterior margin, more distal point of proximal narrowing, segment triangular, 3 posterior spines |
| Pereopod 6, article 5      | Anterior margin rounded gently to distal margin without clear anterodistal angle, 6 spine groups along curve | Article subquadrate with a distinct anterodistal defining lobe, lobe with a cluster of 3 spines, distal and anterior spines present |
| Pereopod 7, coxal plate    | Setae along entire posterior margin                                          | Setae on posterodistal margin only                                        |
| Pereopod 7, article 4      | Spines on distolateral margin limited to posterior one-fourth of margin, closely spaced | Spines on distolateral margin more widely spaced and extending at least one-half length of margin |
| Uropod 1, peduncle         | 3–4 proximal spines, and 1–2 proximal setae                                | 1–2 proximal spines and occasionally 1 proximal seta                     |

1. Uropod 1, dorsolateral margin of peduncle lined throughout out with stout spines; pereopod 7, article 4, proximal margin rounding, continuous with posterior margin; EUROPEAN SPECIES..........................2

Uropod 1, dorsolateral margin of peduncle with proximal and distal groups of spines; pereopod 7, article 4, proximal margin sharply set off from posterior margin; AMERICAN SPECIES..........................3

2. Accessory flagellum 4+ segmented; pereopod 7, posterior margin of article 4 with 3-4 stiff spine groups ........................................... H. arenarius (Slabber)

Accessory flagellum 3-segmented; pereopod 7, proximal and posterior margin of article 4 lined continuously with long stiff setae ................. H. algeriensis Mulot

3. Rostrum very long, extending to the end of antenna 1, peduncle segment 1 ...... Haustorius “long rostrate form”

Rostrum short, not exceeding midpoint of antenna 1, peduncle segment 1 ................................................. 4

4. Pereopod 6, article 5, anterodistal angle broadly rounding; pereopod 7, coxal plate with setae along entire posterior margin, article 4, distolateral marginal spines limited to posterior quarter of distal margin ............................................ H. canadensis Bousfield

Pereopod 6, article 5, anterodistal angle with defining lobe bearing a spine cluster; pereopod 7, coxal plate with setae on posterodistal margin only, article 4, distolateral marginal spines extending to mid-margin ............................................ H. jayneae n. sp.

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### Table 3

Comparison of Selected Characters of the Known Species of *Haustorius*

| Character                                      | H. jayneae | H. conadenis | H. arenarius² | H. algeriensis¹ |
|------------------------------------------------|------------|--------------|---------------|-----------------|
| Antenna 1, # accessory flagellum segments      | 4–5        | 4            | 3–5           | 3–4             |
| Rostrum length relative to dorsally exposed peduncle of antenna 1 | 20%        | 20%          | Less than 20% | Undetermined    |
| Shape of rostrum                               | Subacute   | Acute        | Subacute      | Undetermined    |
| Maxilla 2, outer plate, distal shape           | Subacute   | Subacute     | Acute         | Sharply rounded |
| Pereopod 5, article 4, # anterior spines       | 2–4        | 4            | 4             | 1               |
| Pereopod 5, article 6, # anterior marginal spine groups | 3–4        | 4–5          | 3–4           | 3               |
| Pereopod 6, article 4, width as % length       | 75%        | 67%          | 70%           | 66–70%          |
| Pereopod 6, article 5, shape of anterodistal margin | Anterodistal lobe with spine group | Broadly rounded without lobe | Angular, but without lobe | Rounded |
| Pereopod 7, article 4, distolateral spine locations | Posterior to center of distal margin | Posterior distal margin | Posterior and center of distal margin | Posterior distal margin |
| Uropod 1, peduncle spine locations             | Proximal and distal only | Proximal and distal only | Entire margin | Entire margin |

¹Derived from Mulot (1967) and Bellan-Santini (1989)
²Based upon material from U.S. National Museum and British Museum of Natural History and Lincoln (1979)

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