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Larval stages of *Stenocionops furcatus* (Olivier, 1791) (Decapoda: Brachyura: Majoidea) and a reappraisal of larval morphological characters for Mithracidae

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Stenocionops furcatus is a spider crab found in the western Atlantic, from Georgia, USA to Rio Grande do Sul, Brazil, on sand, coral, rocks or mud bottoms from the intertidal zone to 180 m. We describe all laboratory-reared larval stages of S. furcatus obtained from the northern coast of São Paulo State, Brazil, and compare our data with existing larval descriptions for the genus and other mithracids. The larval development of S. furcatus consists of two zoeal stages and one megalopa. The durations of the first and second zoeal stage were ~4 and 5 days respectively, the megalopa appearing 10–18 days after hatching. Our results show that the zoeae of S. furcatus differ from those of other Mithracidae by possessing four setae on the proximal lobe of the coxal endite of the maxilla, instead of five, and by the presence of mid-dorsal setae on the third abdominal somite in the second zoeal stage, which are lacking in other mithracids. Larval descriptions for Stenocionops in two previous publications were attributed to the subspecies S. furcatus coelatus from the Caribbean. Larvae from Brazilian waters closely resemble one of these accounts, suggesting that this taxon extends beyond the West Indies and that the other description represents larvae of S. furcatus furcatus. Additional morphological details, not available previously, are provided.

INTRODUCTION

Species of *Stenocionops* Desmarest, 1823, are widely distributed throughout the tropical and subtropical coasts of Pacific and Atlantic America and western Africa. *Stenocionops furcatus* [cf. (Williams *et al.*, 1989)], previously mostly known as *S. furcata* [cf. (Williams, 1984)], is a western Atlantic species, ranging from Georgia, USA, to Rio Grande do Sul, Brazil on sand, coral, rocks or mud bottoms from the intertidal zone to 180 m (Melo, 1996).

Seven species, and the subspecies *S. furcatus coelatus*, were recognized by Rathbun (Rathbun, 1925), with more species recognized since, including the subspecies *S. furcatus furcatus* (Blow, 2003; Nizinski, 2003). However, larval descriptions are restricted to the subspecies *S. furcatus coelatus*. Laughlin *et al.* (Laughlin *et al.*, 1984) described the zoeal morphology of *S. furcatus coelatus* (Milne Edwards, 1878) and Bolaños *et al.* (Bolaños *et al.*, 1994) provided a full larval description of this presumed subspecies. According to Rathbun (Rathbun, 1925) and Williams (Williams, 1984), *S. furcatus coelatus* has a restricted distribution within the range of *S. furcatus*, being limited to an area from off Beaufort, NC, to Barbados in the West Indies. On the other hand, some authors [e.g. (Melo, 1996)] do not recognize this subspecies and include its range within the distribution of *S. furcatus* (Holthuis, 1959; Vélez, 1977; Melo, 1999) to Brazil.

The family Mithracidae (Balss, 1929) is represented by 17 genera, predominantly found in the tropical regions of the globe. However, larval accounts of mithracids are known for only about 30% of these genera: *Macrocoeloma* (Yang, 1967; Marques *et al.*, 2003), *Micippa* (Kurata, 1969; Ko, 1995; Siddiqui, 1996), *Microphrys* (Lebour, 1944; Hartnoll, 1964; Yang, 1967; Gore *et al.*, 1982), *Mithrax*

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and *Mithraculus* (Lebour, 1944; Provenzano and Brownell, 1977; Wilson *et al.*, 1979; Scotto and Gore, 1980; Bolaños and Scelzo, 1981; Goy *et al.*, 1981; Fransozo and Hebling, 1982; Bolaños *et al.*, 1990; Santana *et al.*, 2003), *Stenocionops* (Laughlin *et al.*, 1984; Bolaños *et al.*, 1994), and *Tiarinia* (Kurata, 1969; Shikatani, 1988).

Here, we describe the larval morphology of *S. furcatus* and compare it with the descriptions of its subspecies, *S. furcatus coelatus*, in an attempt to recognize distinct morphological differences that might warrant a different taxonomic status for the latter. Based on a comparison with other mithracids we also reappraise the larval morphological characters for that family.

METHOD

Specimens of *S. furcatus* were collected in February 2001 from a depth of 45 m, in the Bay of Ubatuba of northern São Paulo State, (44°43′S, 23°32′W), Brazil. The specimens were held in an aquarium in a temperature-controlled room (24 ± 2°C) until hatching, which occurred at night. After hatching, 50 of the most active, positively phototactic larvae were individualized into 100 mL acrylic jars containing 50 mL filtered sea water. The remaining larvae were kept in mass culture as extra specimens to be used for morphological descriptions.

Newly hatched larvae were fed *ad libitum* with *Artemia* nauplii. Sea water was changed, and specimens were inspected and fed daily. All acrylic jars were washed in freshwater and air-dried before re-use with fresh sea water the following day. Average salinity was 32. A natural photoperiod was maintained (≅14 h light:10 h dark).

Whenever possible, a minimum of five specimens of each stage were dissected for morphological description. For slide preparations polyvinyl lactophenol was used as mounting medium with acid fuchsin and/or chlorazol black stains. The description of setae follows Pohle and Telford (Pohle and Telford, 1981), but here includes only analysis by light microscopy, using a Zeiss Axioskop 2 Plus microscope with Nomarski Differential Interference Contrast and camera lucida. Some of the setae designated as plumose herein may be plumodenticulate setae because of the lower resolution limits of light microscopy as compared to scanning electron microscopy. Generally, the description guidelines of Clark *et al.* (Clark *et al.*, 1998) were followed. Taxonomic rankings follow Martin and Davis (Martin and Davis, 2001) in which majid subfamilies were raised to the family level and included within the Majoidea.

Specimens of larval stages and a spent female crab have been deposited at the Museu de Zoologia da Universidade de São Paulo (MZUSP), São Paulo State, Brazil, accession number 16165.

RESULTS

Larval development

Larval development of *S. furcatus* consists of two zoeal stages and one megalopa. Figure 1 shows the rearing record for the three stages cultured at 24 ± 2°C. The duration of the zoeal stage was 4–11 days (3.9 ± 0.3) for Zoea I and 5–12 days (5.0 ± 0.6) for Zoea II; the megalopa appeared 10–18 days after hatching. Larval morphometrics are given in Table I. Measurements of zoeal stages included: carapace length measured in lateral view from the base of the rostrum to the most posterior

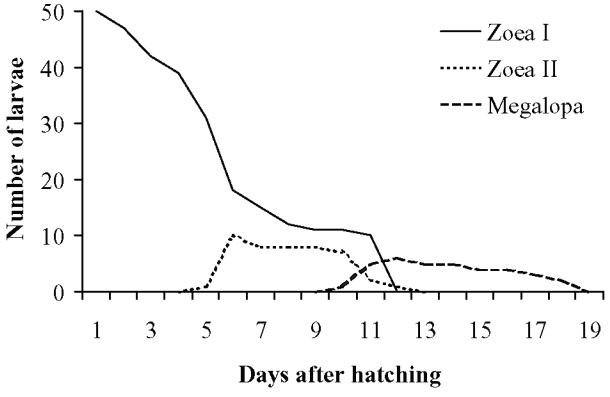

Fig. 1. Rearing record for the three larval stages of *Stenocionops furcatus* (Olivier, 1791) cultured at 24 ± 2°C.

Table I: Dimensions (mm) of larval structures of Stenocionops furcatus (Olivier, 1791)

Species	Rostral spine length	Dorsal spine length	Carapace length	Carapace width
Zoea 1	0.24 ± 0.03 (0.22–0.31)	0.45 ± 0.05 (0.39–0.52)	0.94 ± 0.04 (0.90–1.03)	–
Zoea 2	0.32 ± 0.02 (0.31–0.34)	0.51 ± 0.06 (0.47–0.56)	1.28 ± 0.02 (1.26–1.30)	–
Megalopa	–	–	1.46 ± 0.12 (1.35–1.60)	1.08 ± 0.12 (0.95–1.20)

Note: Values are given as the mean ± standard deviation, with range in parentheses.

margin; the rostrum in lateral view from the ventral margin of the eye to the tip; the dorsal spine in lateral view from the base at the posterior margin to the tip. For the megalopa, carapace length and width were measured in dorsal view, from the tip of the rostrum to the posterior margin, and at this widest point, respectively. Only morphological changes are described for the second zoea.

Description – *Stenocionops furcatus* (Olivier, 1791)

First zoea (Figure 2)

Carapace (Figure 2A). With dorsal spine, bare rostral spine greatly diminished, lateral spines absent. Ventral margin with densely plumose 'anterior seta' (Clark *et al.*, 1998) posterior to scaphognathite notch, followed by two plumose and two plumodenticulate setae. Eyes sessile. Small indistinct median ridge frontally between dorsal spine and eyes and a small median tubercle on posterodorsal margin, each bearing cuticular dorsal organ [*sensu* (Martin and Laverack, 1992)]. Pair of simple setae present anteriorly to dorsal spine and a pair of sparsely plumose setae posterolaterally to dorsal spine.

Antennule (Figure 2B). Unsegmented, smooth, conical. Terminally bearing two long, two shorter aesthetascs, and two short simple setae.

Antenna (Figure 2C). Biramous, protopod long and pointed, bearing two rows of sharp spinules; endopod bud present; one-segmented exopod longer than protopod with long spinulated distal process and pair of serrulate setae about one-third from tip.

Mandible (Figure 2D). With medial toothed molar process and enlarged lateral incisor processes; marginal teeth between molar and incisor processes. Palp absent.

Maxillule (Figure 2E). Coxal endite bearing seven setae, four terminal setae, one plumodenticulate and three graded plumodenticulate; subterminally with three plumodenticulate setae. Basial endite with three terminal plumodenticulate cuspidate setae and four subterminal setae, three plumodenticulate and one plumose. Two-segmented endopod with proximal segment bearing sparsely plumodenticulate seta, distal segment bearing three pairs of plumodenticulate setae, one subapically and two apically. Exopod seta absent.

Maxilla (Figure 2F). Coxal endite bilobed, proximal lobe with four setae, three plumose and one plumodenticulate; distal lobe with five setae, three plumose and two plumodenticulate. Basial endite bilobed, proximal and distal lobes with five and four plumodenticulate setae, respectively. Microtrichia present on both endites. Unsegmented endopod unilobed, with five apical plumodenticulate setae; microtrichia on lateral margin. Scaphognathite marginally with 10 densely plumose setae, including distal process.

Maxilliped 1 (Figure 2A, G). Coxa with simple seta. Basis with 10 plumodenticulate setae arranged 2,2,3,3. Endopod five-segmented with 2–3,2,1,2,4+1 plumodenticulate setae. Incompletely bisegmented exopod with four terminal plumose natatory setae.

Maxilliped 2 (Figure 2A, H). Coxa naked. Basis with three plumodenticulate setae. Endopod two-segmented, with 0,1,5 plumodenticulate setae of different types, two medial, three apical on terminal segment. Incompletely bisegmented exopod with four terminal plumose natatory setae.

Maxilliped 3 (Figure 2I). Present as small endo-, exo- and epipod buds.

Pereiopods (Figure 2I). Present as small buds, chela distinct.

Abdomen (Figure 2A, J). Five somites. Somite 1 with pair of mid-dorsal plumodenticulate setae, somites 2–5 each with pair of shorter posteromedial simple setae. Posterolaterally, somite 2 with blunt process, somites 3–5 with spines; somite 2 with pair of dorsolateral processes. Grouped denticulettes present. Pleopods absent.

Telson (Figure 2J). Bifurcated, very shallow median arch, three pairs of plumodenticulate setae on inner margin; each furcal shaft proximally bearing lateral spine, furcal shafts and spines covered in rows of spinules to just below tips. Grouped denticulettes present.

Second zoea (Figure 3)

Carapace (Figure 3A). Eyes mobile. Additional pair of simple setae at base of dorsal spine and two additional pairs above eyes. Posterolateral margin with six or seven setae of plumose and plumodenticulate type.

Antennule (Figure 3B). With eight long aesthetascs and two short simple setae, one longer; endopod bud absent.

Antenna (Figure 3C). Endopod bud enlarged to just beyond middle of protopodite.

Mandible (Figure 3D). Palp bud present.

Maxillule (Figure 3E). Basial endite with three additional setae (two terminal plumodenticulate cuspidate setae, and one plumose seta proximally); exopod pappose seta present.

Maxilla (Figure 3F). Coxal endite with four setae on distal lobe; basal endite with four or five plumodenticulate setae on distal lobe; scaphognathite with 19–21 marginal plumose setae.

Maxilliped 1 (Figure 3A). Exopod with six plumose natatory setae.

Maxilliped 2 (Figure 3A). Exopod with six plumose natatory setae.

Maxilliped 3 (Figure 3G). Lobes of exo-, endo- and epipod enlarged.

Pereiopods (Figure 3G). Longer, chela enlarged.

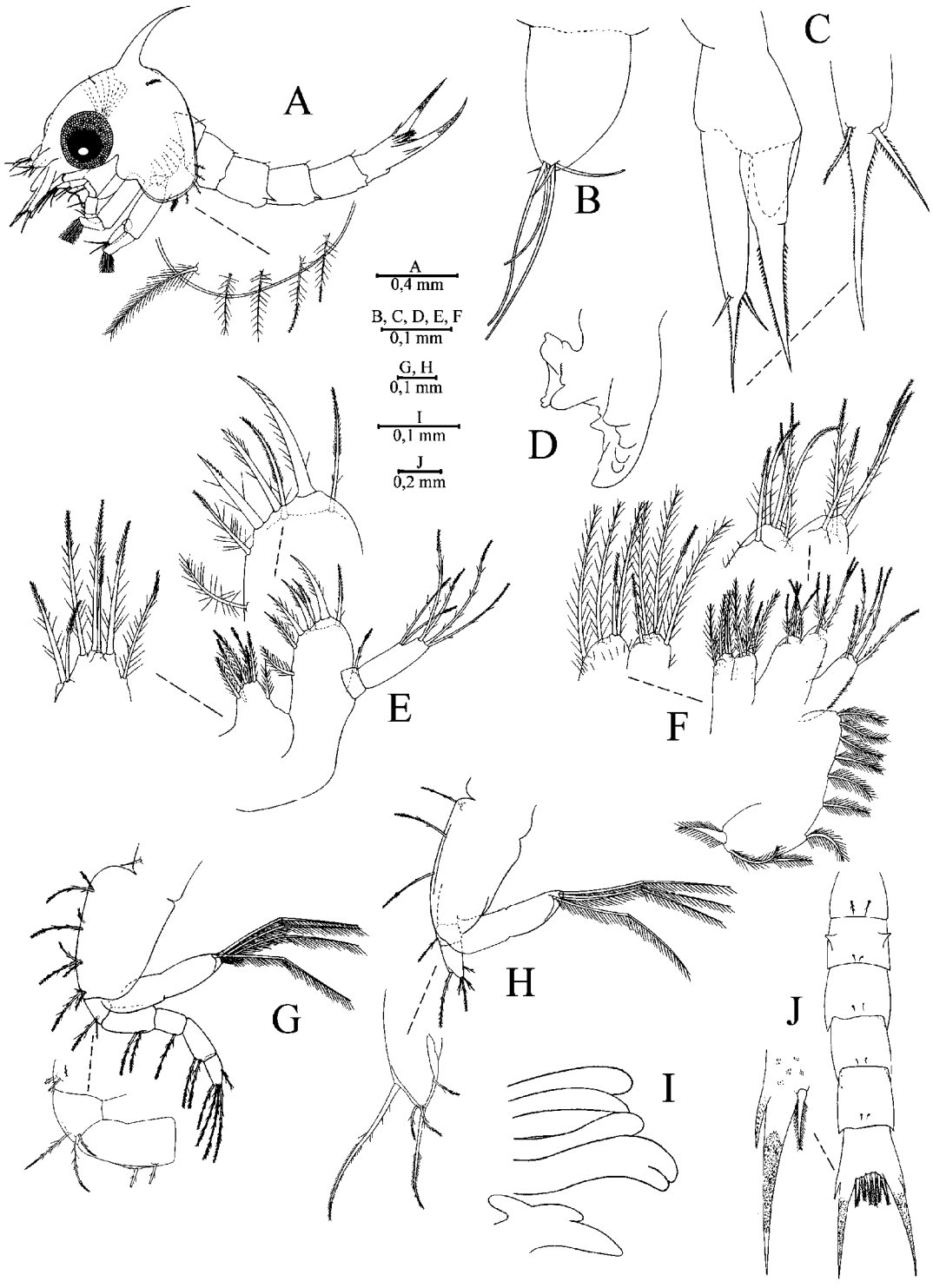

Fig. 2. First zoea of *Stenocionops furcatus* (Olivier, 1791). (**A**) lateral view; (**B**) antennule; (**C**) antenna; (**D**) mandible; (**E**) maxillule; (**F**) maxilla; (**G**) maxilliped 1; (**H**) maxilliped 2; (**I**) developing maxilliped 3 and pereiopods; (**J**) dorsal view of abdomen and telson.

Abdomen (Figure 3H). Additional sixth somite. Somite 1 with three dorsal plumodenticulate setae. Somites 2 and 3 with additional pair of simple setae on mid-dorsal region. Posterolaterally, somites 1 and 6 with blunt processes, somites 2–5 with enlarged spines as shown. Pair of unsegmented biramous pleopods on somites 2–5, endopods very small.

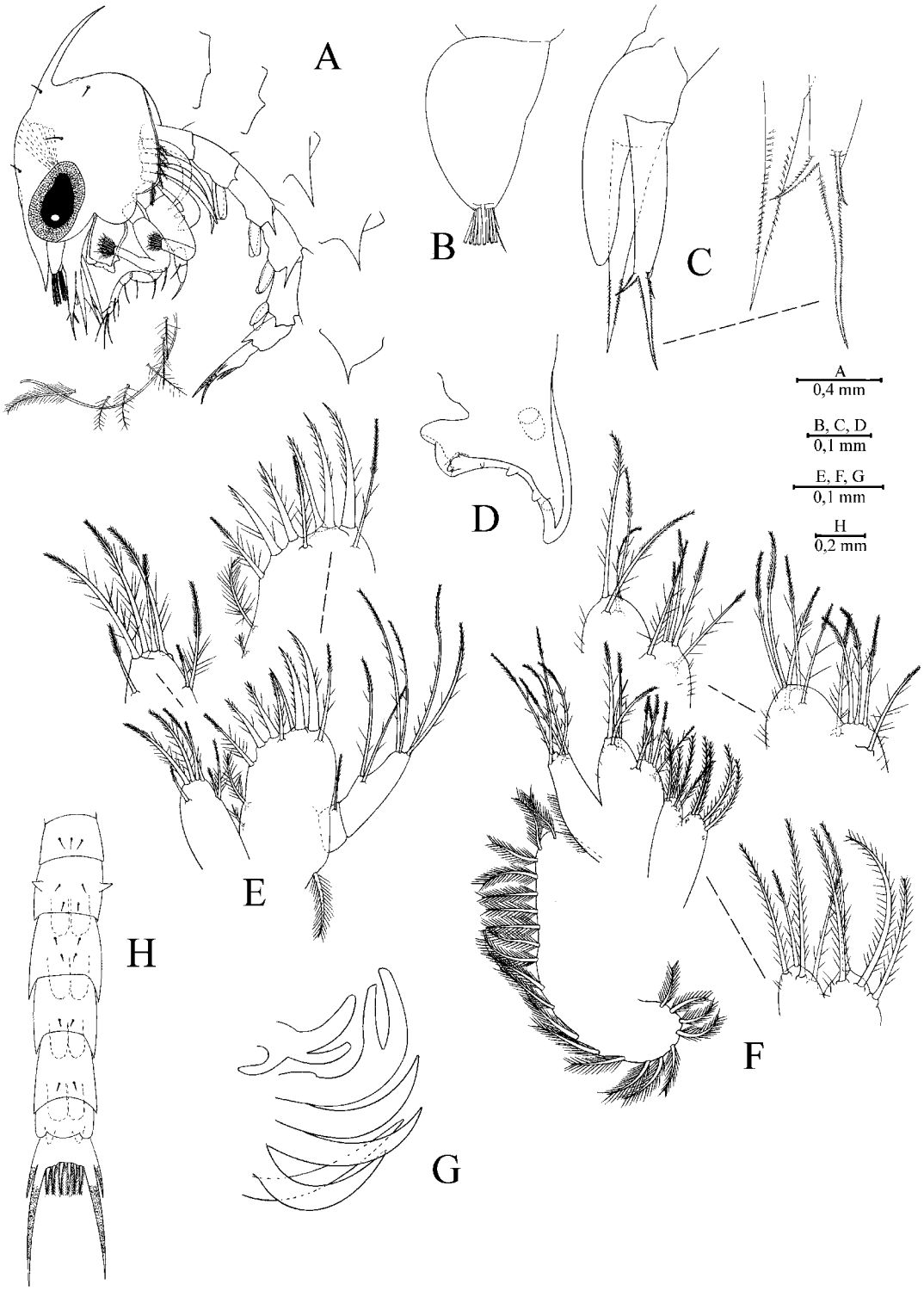

Fig. 3. Second zoea of *Stenocionops furcatus* (Olivier, 1791). (**A**) lateral view; (**B**) antennule; (**C**) antenna; (**D**) mandible; (**E**) maxillule; (**F**) maxilla; (**G**) developing maxilliped 3 and pereiopods; (**H**) dorsal view of abdominal somites 1–6, showing ventral pleopods as stippling.

Megalopa (Figures 4 and 5)

Carapace (Figure 4A). Longer than wide, narrowing anteriorly, with small rostral spine deflected slightly ventrally; lateral and dorsolateral ridge extending from eyes to branchial area, each with two knob-like elevations just posterior to eyes, and two additional

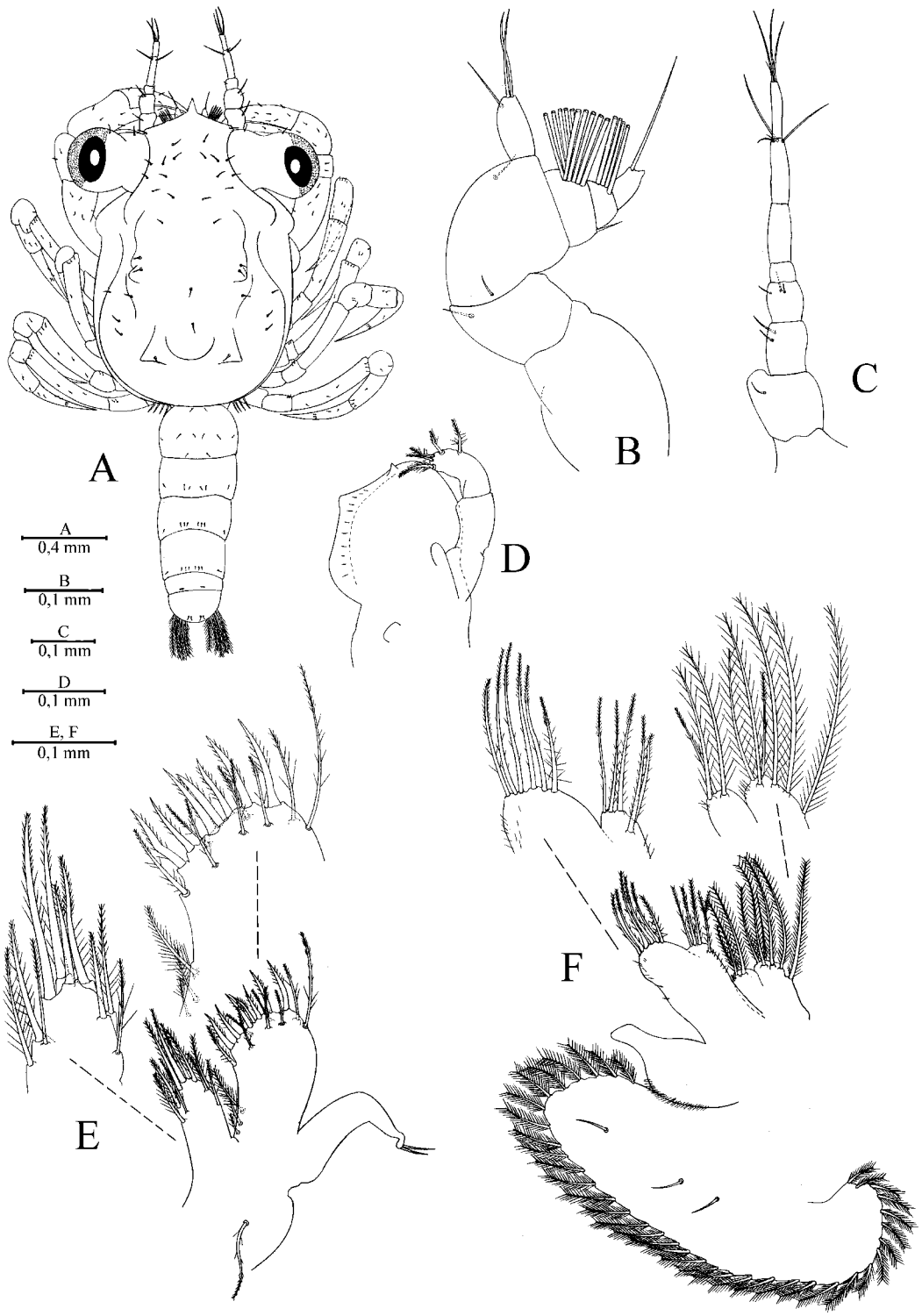

Fig. 4. Megalopa of *Stenocionops furcatus* (Olivier, 1791). (**A**) dorsal view; (**B**) antennule; (**C**) antenna; (**D**) mandible; (**E**) maxillule; (**F**) maxilla.

pairs of dorsal protuberances near border of gastric area. One tubercle on the cardiac area, and a pair of pointed knob-like elevations on the metabranquial region. Posterolateral margin with series of four plumodenticulate setae, surface covered with mostly simple setae as shown.

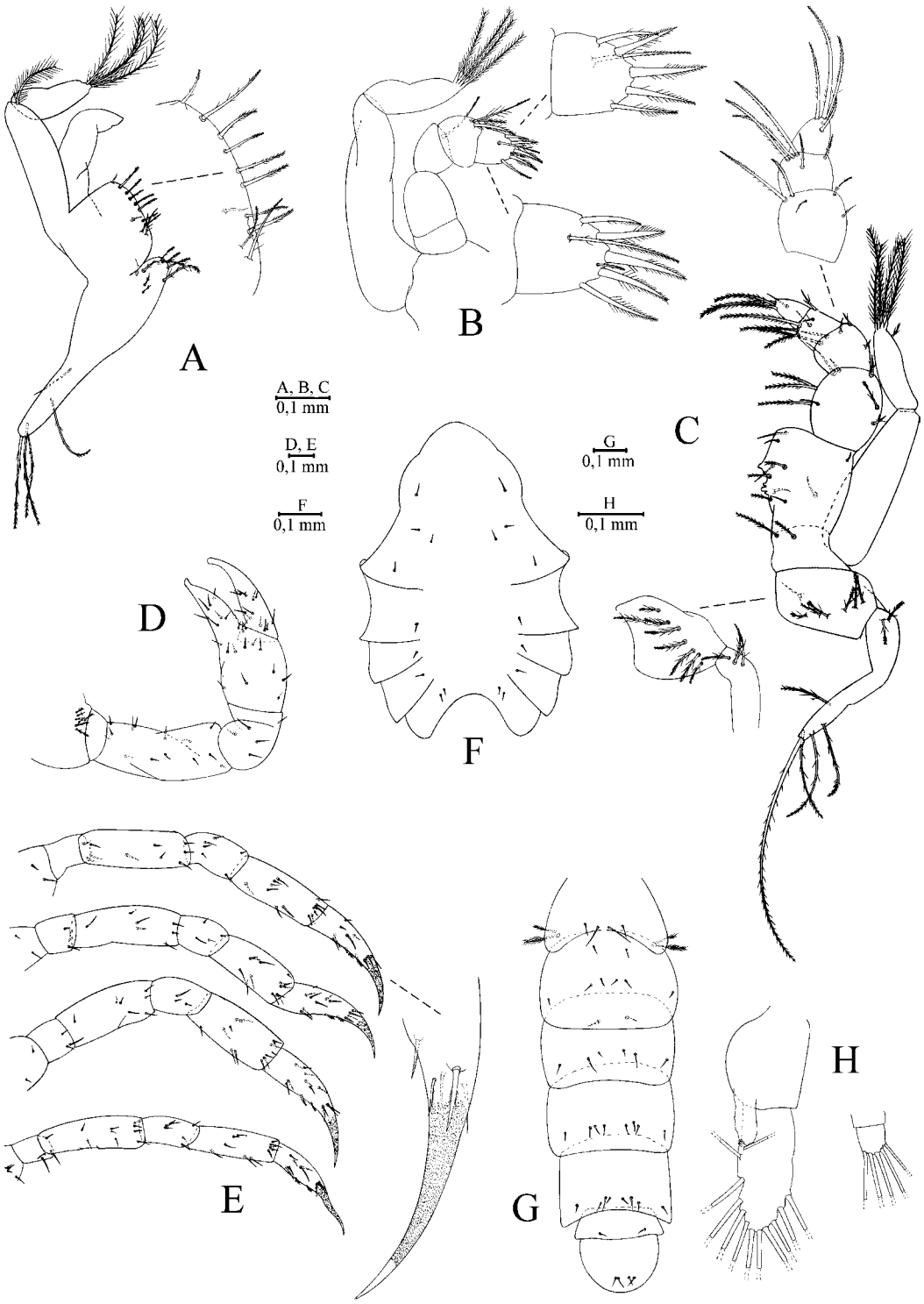

Fig. 5. Megalopa of *Stenocionops furcatus* (Olivier, 1791). (**A**) maxilliped 1; (**B**) maxilliped 2; (**C**) maxilliped 3; (**D**) cheliped; (**E**) pereiopods; (**F**) sternum; (**G**) dorsal view of abdomen and telson; (**H**) first and fifth pleopods.

Antennule (Figure 4B). Three-segmented peduncle with a simple seta on middle segment, two on distal segment; endopod with one subterminal and two terminal simple setae; three-segmented exopod with first segment bearing 10 aesthetascs and simple seta, middle segment with four aesthetascs and distal segment with aesthetasc-like apical seta.

Antenna (Figure 4C). Segments 1–7, progressing proximally to distally, each with 1,2,3,0,0,4,4 simple setae, respectively; three terminal setae long and one short. Basal segment with shortened exopod process.

Mandibles (Figure 4D). Asymmetric, scoop-shaped process with cutting edge and small tooth; two-segmented palp bearing five plumodenticulate setae on the distal segment.

Maxillule (Figure 4E). Coxal endite with four graded plumodenticulate and six plumodenticulate setae. Basial endite distal to endopod with 15 apical plumodenticulate setae and three plumose setae on proximal margin. Epipod plumodenticulate seta present; endopod with two simple setae.

Maxilla (Figure 4F). Coxal endite proximal lobe with one plumodenticulate and five plumose setae, distal lobe bearing one plumodenticulate and two plumose setae; basial endite with five plumodenticulate setae on proximal lobe, six on distal lobe. Endopod shortened, without setae, with microtrichia on distal lobe. Scaphognathite with 35–36 marginal plumose setae; blade with three simple setae.

Maxilliped 1 (Figure 5A). Coxa with eight, basis bearing 11 plumodenticulate setae; endopod naked; exopod with pappose seta distally on proximal segment and four plumose setae on distal segment; epipod with five plumodenticulate setae.

Maxilliped 2 (Figure 5B). Coxa and basis not clearly differentiated; endopod ischium and merus differentiated but without setae, carpus, propod and dactyl with one, three and six or seven plumodenticulate setae, respectively; exopod with naked proximal segment and four plumose setae on distal segment.

Maxilliped 3 (Figure 5C). Coxa with seven to eight plumose setae, basis not clearly differentiated, with two plumodenticulate setae; endopod proximally to distally with 10, 9, 5, 5–6 and 4 plumodenticulate setae; ischium with protuberances indicative of crista dentata; bisegmented exopod with naked proximal segment, distal segment bearing four short plumose setae apically, one subterminally; epipod with two or three plumodenticulate setae proximally, five distally.

Pereiopods (Figure 5D, E). Cheliped with mostly simple setae, except for plumose setae on coxa; pereiopods 2–5 mostly with simple setae, some serrulate setae near tip of dactyls; basischial segments without spines; dactyls of pereiopods 1–4 with rows of spinules as shown.

Sternum (Figure 5F). Anterior sternal segment with four pairs of simple setae as shown, subsequent segments with setation as shown.

Abdomen (Figure 5G, H). Somites 1–6 proximally to distally with 4,8,8,8,8,2 simple setae dorsally and laterally; somite 1 with two additional pairs of distinct plumose setae ventrolaterally. Five pairs of pleopods, exopod of pleopods 1–5 with 12, 11, 10, 9 and 5 plumose setae, respectively; endopod of pleopods 1–4 with two cincinnuli each, pleopod 5, i.e. uropod, lacking endopod.

Telson (Figure 5G). Rounded posteriorly, bearing two pairs of simple mid-dorsal setae.

DISCUSSION

Larval characters in Mithracidae

The larval development of *S. furcatus* conforms with the general pattern known for the Majoidea. Within this group, complete larval development is achieved by two zoeal stages and a megalopa, and larvae are characterized by the possession of nine or more setae on the scaphognathite in the first zoea and by pleopods being well developed in the second zoeal stage (Rice, 1980, 1983).

Within the Majoidea, Yang (Yang, 1967) suggested that the larval characters of Mithracidae seem to be consistent, especially during zoeal stages. However, Ingle (Ingle, 1979) characterized two groups within the Mithracidae based on larval features. The characters observed for *S. furcatus* in the present study agree with those proposed for Ingle's Group I. This group is characterized by the absence of carapace lateral spines, a dorsal spine of moderate length, a short rostral spine, only one spine on each telson fork, dorsolateral process on the second abdominal somite, posterolateral process on abdominal somites 3–5 sometimes short, basal segment of second maxilliped without setae, and antennal exopod with subterminal setae. For Group I, the megalopa is characterized by a rostrum that is deflected slightly ventrally, submedian processes on the carapace, a short cardiac spine, a basal segment on the second pereiopod without spines, and a uropod being present. These features were also observed for the larvae described in the present study, therefore agreeing with Ingle's Group I in all aspects.

The larval features of *S. furcatus* are very similar to other mithracids, with the exception of *Micippa philyra*, the latter being a rather atypical mithracid in lacking a dorsal carapace spine, having more spines on the telson fork and fewer setae on the endopod of the second maxilliped, etc. (Tables II, III and IV). Zoeae of *S. furcatus* can be separated from those of other genera by the number of setae on the scaphognathite and coxal endite of the maxilla (Tables II and III). In the megalopa, this species is characterized by the distinct number of aesthetascs and antennular peduncle setation, the number of epipod setae on the third maxilliped, and by abdominal setation (Table IV). Together these larval characters appear diagnostic for this species and could also be useful to infer phylogenetic relationships.

Table II: Comparison of larval characters of first zoeal stage for species of the family Mithracidae

Zoea I	Carapace	Antennule	Maxillule	Maxilla	Mxpd 1	Mxpd 2	Abdomen	Telson
Stenocionops furcatus Present study	2 s, 2 pl; 3 pl, 2 pld	2+2 ae; 2 s	cox: 7 pld; bas: 6 pld + 1pl; end: 7 pld	cox: 3 pl + 1 pld, 3 pl + 2 pld; bas: 5 pld, 4 pld; end: 5 pld; sca: 10	cox: 1 s; bas: 10 pld; end: 3,2,1,2,5 pld	bas: 3 pld; end: 0,1,5 pld	S1: 2 pld; S2–5: 2 s	6 pld
Macrocoeloma diplacanthum Marques *et al.* (2003)	4 s; 5–6 pl	2+1 ae; 1 s	cox: 7 pld; bas: 6 pld + 1pl; end: 6 pld	cox: 4 pl + 1 pld, 4 pld; bas: 5 pld, 4 pld; end: 5 pld; sca: 11	cox: 1 s; bas: 10 pld; end: 3,2,1,2,4 pld + 1sp	bas: 3 pld; end: 0,1,5 pld	S1: 2 pl; S2–5: 2 s	7 pld
Micippa philyra Ko (1995)	2 ?; 6 ?	3 ae; 1 s	cox: 7 pld; bas: 7 pld; end: 7 pld	cox: 5 pld, 4 pld; bas: 5 pld, 4 pld; end: 6 pld; sca: 23	cox: 0 *; bas: 10 pld; end: 3,2,1,2,5 pld	bas: 3 pld; end: 0,1,4 pld	S1: 2 ?; S2–5: 2 ?	6 den
Microphrys bicornutus Gore *et al.* (1982)	4 s*; 6 s?	2+2 ae; 1 s	cox: 7 pld?*; bas: 7 pld?*; end: 7 pld?*	cox: 5 pld?*, 4 pld?*; bas: 5 pld?*, 4 pld?*; end: 5 pld?*; sca: 13–14	cox: 1 pld?*; bas: 10 pld?*; end: 3,2,1,2,5 pld?*	bas: 3 pld?*; end: 0,1,5 pld?*	S1–5: 2 s	6 ?
Mithrax spinosissimus Provenzano and Brownell (1977)	n/d	3+2 ae	cox: 5 s; bas: 6 s; end: 2 s	cox: 1 s, 1 s; bas: 3 s, 3 s; end: 1 s; sca: 30	cox: 0 *; bas: 0 *; end: 0,1,1,2,3–4 s	bas: 0 *; end: 1 or 3 s	n/d	6 pld?*
Mithrax verrucosus Bolanos and Scelzo (1981)	3 ?	4 ae ? 2 ?	cox: 6 ?; bas: 7 ?; end: 7 ?	cox: 5 ?, 4 ?; bas: 5 ?, 4 ?; end: 5 ?; sca: 13	cox: 1 ?; bas: 10 ?; end: 3,2,1,2,5 ?	bas: 3 ?; end: 0,1,5 ?	n/d	n/d
Mithrax pleuracanthus Goy *et al.* (1981)	4 s; 6 pl	2+1 ae; 1 s	cox: 7 pld; bas: 7 pld; end: 7 pld	cox: 5 pld, 4 pld; bas: 5 pld, 4 pld; end: 5 pld; sca: 13	cox: 1 pld; bas: 10 pld; end: 3,2,1,2,5 pld	bas: 3 s; end: 0, 1 pld, 2 pld + 3 s	S1–5: 2 s	6 pld
Mithrax caribbaeus Bolanos *et al.* (1990)	2 s, 2 pld; 7 pld	2+2 ae; 2 s	cox: 7 pld; bas: 7 pld; end: 2 si, 5 pld	cox: 5 pld, 4 pld; bas: 5 pld, 4 pld; end: 5 pld; sca: 13	cox: 1 s; bas: 10 pld; end: 3,2,1,2,5 pld	bas: 2 pld, 1 s; end: 0,1 pld, 1 pld + 4 s	S1–5: 2 pld	6 spr
Mithrax hispidus Santana *et al.* (2003)	2 s, 2 pl; 4 pl, 2 pld	2+2 ae; 1 s	cox: 6 pld + 1 pl; bas: 6 pld + 1 pl; end: 7 pld	cox: 4 pl + 1 pld, 3 pl + 1 pld; bas: 5 pld, 4 pld; end: 5 pld; sca: 13	cox: 1 s; bas: 10 pld; end: 3,2,1,2,5 pld	bas: 3 pld; end: 0,1,5 pld	S1: 2 pld; S2–5: 2 s	6 pld
Mithraculus forceps Wilson *et al.* (1979)	4 s; 6 pl?*	2+2 ae; 1 s	cox: 7 pld?*; bas: 7 pld?*; end: 7 pld?*	cox: 5 pld?*, 4 pld?*; bas: 5 pld?*, 4 pld?*; end: 5 pld?*; sca: 13	cox: 1 pld?*; bas: 10 pld?*; end: 3,2,1,2,5 pld?*	bas: 3 pld?*; end: 0,1,5 pld?*	S1–5: 2 s	6 ?
Mithraculus coryphe Scotto and Gore (1980)	4 s; 6 pl?*	2+2 ae; 1 s	cox: 7 pld?*; bas: 7 pld?*; end: 7 pld?*	cox: 5 pld?*, 4 pld?*; bas: 5 pld?*, 4 pld?*; end: 5 pld?*; sca: 13	cox: 1 pld?*; bas: 10 pld?*; end: 3,2,1,2,5 pld?*	bas: 3 pld?*; end: 0,1,5 pld?*	S1–5: 2 s	6 ?

sca, scaphognathite; cox, coxa or coxal endite; bas, basis or basial endite; end, endopod; exo, exopod; epi, epipod; ped, peduncle; seg, segments; S, somites; P, pleopods; pl, plumose setae; s, simple setae; den, denticulate; pld, plumodenticulate setae; pap, pappose setae; ae, aesthetascs; sp, spine; ser, serrulate; spr, spinulose processes; set, setose setae; n/d, not described; ?, setal type not specified; *, observation from figure.

Table III: Comparisons of larval characters of second zoeal stage for species of the family Mithracidae

Zoea II	Carapace	Antennule	Maxillule	Maxilla	Mxpd 1	Mxpd 2	Abdomen
Stenocionops furcatus Present study	10 s; 6–7 pl+pld	8 ae; 2 s;	cox: 7 pld; bas: 8 pld + 2pl; end: 7 pld; exo: 1 pap	cox: 3 pl + 1 pld, 2 pl + 2 pld; bas: 5 pld, 4–5 pld; endo: 5 pld; sca: 19–21	cox: 1 s; bas: 10 pld; end: 3,2,1,2,5 pld; exo: 6 pl	bas: 3 pld; end: 0,1,5 pld; exo: 6 pl	S1: 3 pld; S2: 4 s
Macrocoeloma diplacanthum Marques *et al.* (2003)	11 s; 8 pl+pld	7 ae; 1 s;	cox: 8 pld; bas: 8 pld + 2pl; end: 7 pld; exo: 1 pap	cox: 4 pl + 1 pld, 4 pld; bas: 5 pld, 5 pld; end: 5 pld; sca: 20	cox: 1 s; bas: 10 pld; end: 3,2,1,2,4 pld + 1 sp; exo: 6 pl	bas: 3 pld; end: 0,1,5 pld; exo: 6 pl	S1: 3 pld; S2–3: 4 s
Micippa philyra Ko (1995)	6 ?; 7 ?	7 ae; 1 s;	cox: 8 pld?*; bas: 9 pld?*; end: 7 pld?*; exo: 1 pl	cox: 5 pld, 4 pld; bas: 5 pld, 5 pld; end: 6 pld; sca: 28	cox: 0 *; bas: 10 pld; end: 3,2,1,2,5 pld; exo: 6 pl	bas: 3 pld; end: 0,1,4 pld; exo: 6 pl	S1: 3 ?; S2–3: 2 s
Microphrys bicornutus Gore *et al.* (1982)	10 s*; 7 pl?	7 ae; 1 s;	cox: 7 pld?*; bas: 10 pld?*; end: 7 pld?*; exo: 1 pl	cox: 5 pld?*, 4 pld?*; bas: 5 pld?*, 5 pld?*; end: 5 pld?*; sca: 23–25	cox: 1 pld?*; bas: 10 pld?*; end: 3,2,1,2,5 pld?*; exo: 6 pl	bas: 3 pld?*; end: 0,1,5 pld?*; exo: 6 pl	S1: 3 s?*; S2: 4 s?*
Mithrax spinosissimus Provenzano and Brownell (1977)	n/d	3+2 ae;	cox: 5 s; bas: 7 s; end: 2 s?* exo: 0 *	cox: 1 s?*, 1 s?*; bas: 2 s?*, 2 s?*; end: 2 s?*; sca: 31	cox: 0 *; bas: 0 *; end: 1,1,1,1,3–4 s?*; exo: 5–6 pl	bas: 0 *; end: 2 s; exo: 5–6 pl	n/d
Mithrax verrucosus Bolanos and Scelzo (1981)	6 ?	8 ae ?; 1 ?;	cox: 7 ?; bas: 9 ?; end: 7 ?; exo: n/d	cox: 5 ?, 4 ?; bas: 5 ?, 5 ?; end: 5 ?; sca: 24	cox: 1 ?; bas: 10 ?; end: 3,2,1,2,5 ?; exo: 6 ?	bas: 3 ?; end: 0,1,5 ?; exo: 6 ?	n/d
Mithrax pleuracanthus Goy *et al.* (1981)	10 s; 8 pl	7 ae; 1 s;	cox: 7 pld; bas: 11 pld; end: 7 pld; exo: 1 pld ?*	cox: 5 pld, 5 pld; bas: 5 pld, 5 pld; end: 5 pld; sca: 24	cox: 1 pld; bas: 10 pld; end: 3,2,1,2,5 pld; exo: 6 pl	bas: 3 s; end: 0,1,1 s + 3 pld; exo: 6 pl	S1: 3 s; S2: 4 s
Mithrax caribbaeus Bolanos *et al.* (1990)	12 pld; 8 pld	8 ae; 2 s;	cox: 8 pld; bas: 10 pld; end: 7 pld; exo: 1 pld	cox: 5 pld, 4 pld; bas: 5 pld, 5 pld; end: 5 pld; sca: 24	cox: 1 s; bas: 10 pld; end: 3,2,1,2,5 pld; exo: 6 pl	bas: 2 pld, 1 s; end: 0,1 pld, 1 pld + 4 si; exo: 6 pl	S1: 3 pld; S2: 4 s
Mithrax hispidus Santana *et al.* (2003)	10–12 s; 7–8 pl+pld	8 ae; 1 s;	cox: 6 pld + 2 pl; bas: 8 pld + 2 pl; end: 7 pld; exo: 1 pap	cox: 4 pl + 1 pld, 3 pl + 1 pld; bas: 4–5 pld, 5 pld; endo: 5 pld; sca: 24–25	cox: 1 s; bas: 10 pld; end: 3,2,1,2,5 pld; exo: 6 pl	cox: 1 s; bas: 10 pld; end: 3,2,1,2,5 pld; exo: 6 pl	S1: 3 pld; S2: 4 s
Mithraculus forceps Wilson *et al.* (1979)	10 s*; 7 pl?	7 ae; 1 s;	cox: 7 pld?*; bas: 10 pld?*; end: 7 pld?*; exo: 1 pld?*	cox: 5 pld?*, 4 pld?*; bas: 5 pld?*, 5 pld?*; end: 5 pld?*; sca: 24	cox: 1 pld?*; bas: 10 pld?*; end: 3,2,1,2,5 pld?*; exo: 6 pl?*	bas: 3 pld?*; end: 0,1,5 pld?*; exo: 6 pl?*	S1: 3 s?*; S2: 4 s?*
Mithraculus coryphe Scotto and Gore (1980)	10 s*; 7 pl?	8 ae; 1 s;	cox: 7 pld?*; bas: 10 pld?*; end: 7 pld?*; exo: 1 pld?*	cox: 5 pld?*, 4 pld?*; bas: 5 pld?*, 5 pld?*; end: 5 pld?*; sca: 24	cox: 1 pld?*; bas: 10 pld?*; end: 3,2,1,2,5 pld?*; exo: 6 pl?*	bas: 3 pld?*; end: 0,1,5 pld?*; exo: 6 pl?*	S1: 3 s?*; S2: 4 s?*

See Table II for definitions of abbreviations.

Table IV: Comparisons of larval characters of megalopa stage for species of the family Mithracidae

Megalopa	Antennule	Antenna	Mandible	Maxillule	Maxilla	Mxpd 1	Mxpd 2	Mxpd 3	Abdomen	Pleopods	Pereiopods
Stenocionops furcatus Present study	ped: 0,1,2 s; end: 3 s; exo: 10 ae + 1s, 5 ae	seg 1–7: 1,2,3,0,0,4,4 s	palp: 5 pld	cox: 10 pld; bas: 15 pld, 3 pl; end: 2 s; epi: 1 pl	cox: 5 pl + 1 pld, 2 pl + 1 pld; bas: 5 pld, 6 pld; end: 0; sca: 35–36, 3 s	cox: 8 pld; bas: 11 pld; end: 0; exo: 1 pap, 4 pl; epi: 5 pld	end: 0,1,3,6–7 pld; exo: 0, 4 pl	cox: 7–8 pl; end: 12, 9,5,5–6,4 pld; exo: 4 pl; epi: 7–8 pld	S1–6: 4,8,8, 8,8,2 s; S1: 4 pl	P1–5: 12,11, 10,9,5 pl	setae: mostly s
Macrocoeloma diplacanthum Marques *et al.* (2003)	ped: 0,2,1 pld; end: 3 s; exo: 7 ae + 1s, 4 ae + 2 s	seg 1–7: 1,2,3,0,0,4,4 s	palp: 5 pld	cox: 8–10 pld; bas: 15 pld, 3 pl; end: 6 s; epi: 1 pl	cox: 5–6 pl + 1 pld, 2 pl + 2 pld; bas: 7–8 pld, 8 pld; end: 1–4; sca: 29–38, 3 s	cox: 7 pld; bas: 10–16 pld; end: 0–2 pl + 3–4 pld; exo: 1 pap, 4–6 pl; epi: 5–6 pld	end: 0,1,3–4,6 pld; exo: 0, 4–6 pl	cox: 6 pl; end: 11–12, 8,4–5, 5–6,4–5 pld; exo: 5 pl; epi: 3–4 pld	S1–6: 8,6,6, 6,6,2 s	P1–5: 11,11, 11,8,5 pl	setae: mostly ser
Micippa philyra Ko (1995)	ped: 1,1,1 ?; end: 3 pld; exo: 4 ae, 1 s?*, 3 ae + 1 s?*	seg 1–7*: 1,2,3,0,0,4,4 s	palp: 4 s	cox: 11 pld; bas: 17 pld; end: 1 s?*; epi: 1 pl	cox: 10 pld, 5 pld; bas: 6pld, 6 pld; end: 0; sca: 33, 3 ?	cox: 6 pld; bas: 10 pld; end: 0; exo: 1 pl, 4 pl; epi: 5 pld	end: 1,1,3,5 pld; exo: 0, 5 pl	cox: 7 pld; end: 14, 8,5,6,4 pld; exo: 1 s, 6 pl; epi: 6 pld	n/d	n/d	n/d
Microphrys bicornutus Gore *et al.* (1982)	ped: 0,1,1 pld?*; end: 3 pld?*; exo: 7 ae + 1 s?*; 5 ae	seg 1–7: 1,2,3,0,0,4,4 pld?*	palp: 5 pld?*	cox: 10 pld?*; bas: 18 pld?*; end: 0; epi: 0	cox: 7 pld?*, 3 pld?*; bas: 6 pld?*, 6 pld?*; end: 0; sca: 28–31, 3 pld?*	cox: 6–7 pld?*; bas: 9–11 pld?*; end: 0; exo: 1 pl?*, 4 pl?*; epi: 5 pld?*	end: 0,1,3,6 pld?*; exo: 0, 4 pl?*	cox: 6 pld?*; end: 12, 9,5, 6,4 pld?*; exo: 6 pl?*; epi: 5 pld?*	S1–6: 6,8,6, 8,6,2 s; S1: 0	P1–5: 11,11, 10–11,8–10,5 pl?*	setae: s?*
Mithrax spinosissimus Provenzano and Brownell (1977)	ped: 0,0,1 s?*; end: 3 s?*; exo: 5 ae + 1 s?*; 4 ae*	seg 1–6: 2,2,2,0,4,3 s?*	palp: 5 s	cox: 8 s?*; bas: 12–15 s?*; end: 0; epi: 0 *	cox: 3–5 s?*, 3–5 ?*; bas: 5–6 s?*, 5–6 s?*; end: 1s?*; sca: 33–37, 0	cox: 8 s?*; bas: 8 s?*; end: 0; exo: 0 *, 4–6 pl; epi: 4 s?*	end: 0,1,3,6 s?*; exo: 0, 4–6 pl	cox: 4 pld?*; end: 12, 5,5, 3,4 pld?*; exo: 4 pl; epi: 4–6 s?*	n/d	P1–5: 9–10,11, 10–11,9,5–6 pl?*	setae: s?*
Mithrax verrucosus Bolanos and Scelzo (1981)	ped: n/d; end: n/d; exo: 7 ae; 5 ae	seg 1–7: 0,2,3,0,0,4,4 ?	palp: 5 ?	cox: 10 ?; bas: 17 ?; end: 2 ?; epi: 1 ?	cox: 7 ?, 3 ?; bas: 5 ?, 6 ?; end: 0; sca: 31 ?	cox: 7 ?; bas: 10 ?; end: 2 ?; exo: 1 ?, 5 ?; epi: 7 ?	end: 0,1,3,6 ?; exo: 0, 4 ?	cox: 6 ?; end: 10,7,5,5,4 ?; exo: 6 ?; epi: 4 ?	n/d	P1–5: 11,11, 11,9,5 ?	n/d

Mithrax pleuracanthus Goy *et al.* (1981)	ped: 0,2,1 pld; end: 3 pld; exo: 8 ae + 1 pld; 5 ae	seg 1–7: 0,2,3,0,0,4,2 pld + 1 s	palp: 5 pld	cox: 10 pld; bas: 15 pld; end: 2 s; epi: 0	cox: 7 pld, 3 pld; bas: 6pld, 6 pld; end: 2 s; sca: 28–39, 7 pld ?*	cox: 3 pld; bas: 10 pld; end: 1 pld, 1 s; exo: 1pld, 4 pl; epi: 4 s, 1 pld	end: 1,1,4,6 pld; exo: 0, 4 pl	cox: 10 pld; end: 12, 7,4,6,4 pld; exo: 6 pl; epi: 5	S1–6: 2,4,4, 4,4,2 s; S1: 0	P1–5: 11,11, 10,9,5 pl	setae: pld
Mithrax caribbaeus Bolanos *et al.* (1990)	ped: 0,2,1 s; end: 3 s; exo: 9 ae + 1 s, 5 ae	seg 1–7: 1,2,3,0,0,4,4 s	palp: 5 pld	cox: 10 pld; bas: 15 pld, 3; end: 2 s; epi: 1 pl	cox: 7 pld, 3 pld; bas: 6 pld, 6 pld; end: 0; sca: 32, 2 s	cox: 8 pld; bas: 11 pld; end: 0; exo: 1 pl, 4 pl; epi: 7 pld	end: 0,1,3,6 pld; exo: 0, 4 pl	cox: 7 pld; end: 12, 9,5,6,4 pld; exo: 6 pl; epi: 5 pld	S1–6: 2,8,6, 8,8,2 s; S1: 4 pl;	P1–5: 11,11, 11,9,5 pl	setae: mostly s
Mithrax hispidus Santana *et al.* (*in press*)	ped: 0,2,1 s; end: 3 s; exo: 8 ae, 5 ae	seg 1–7: 1 or 3,2,3,0,0,4,3 s	palp: 5 pld	cox: 8 pld, 2 pl; bas: 13 or 15 pld, 3 pl; end: 2 s; epi: 1 pld	cox: 6–7 pl + 1 pld, 2 pl + 1 pld; bas: 5–6 pld, 6 pld; end: 0; sca: 27–31, 3 s	cox: 7–8 pld; bas: 10–11 pld; end: 0; exo: 1 pap, 4 pl; epi: 3–5 pld	end: 0,1,2–3,5–6 pld; exo: 0, 4 pl	cox: 6–7 pl; end: 11–12, 8–9, 5,5,4 pld; exo: 6 pl; epi: 4–5 pld	S1–6: 2,8,6, 8,8,2 s; S1: 4 pl	P1–5: 11,11, 10,9,5 pl	setae: mostly s
Mithraculus forceps Wilson *et al.* (1979)	ped: 0,2,1 pld?*; end: 3 pld?*; exo: 7 ae + 1 s?*; 5 ae	seg 1–7: 1,2,3,0,0,4,4 s?*	palp: 5 pld	cox: 10 pld?*; bas: 18 pld?*; end: 0; epi: 1 pld?*	cox: 7 pld?*, 3 pld?*; bas: 6 pld?*, 6 pld?*; end: 0; sca: 26–30, 3 pld?*	cox: 5–7 pld?*; bas: 9–11 pld?*; end: 0; exo: 1 pl?*, 4 pl?*; epi: 6 pld?*	end: 0,1,3,6 pld?*; exo: 0, 4 pl?*	cox: 5–7 pld?*; end: 12, 9,5, 4–6,3–4 pld?*; exo: 6 pl?*; epi: 5–6 pld?*	not clear	P1–5: 11,11,11, 9,5 pl?*	setae: pld?*
Mithraculus coryphe Scotto and Gore (1980)	ped: 0,2,1 pld?*; end: 3 pld?*; exo: 7 ae + 1 s?*; 5 ae	seg 1–7: 1,2,3,0,0,4,4 s?*	palp: 5 pld	cox: 10 pld?*; bas: 18 pld?*; end: 0; epi: 1 pld?*	cox: 7 pld?*, 3 pld?*; bas: 6 pld?*, 6 pld?*; end: 0; sca: 29–33, 3 pld?*	cox: 5–7 pld?*; bas: 9–11 pld?*; end: 0; exo: 1 pl?*, 4 pl?*; epi: 6–7 pld?*	end: 0,1,3,6 pld?*; exo: 0, 4 pl?*	cox: 5–7 pld?*; end: 12,9,5, 4–6,3–4 pld?*; exo: 6 pl?*; epi: 4–6 pld?*	not clear	P1–5: 11,11, 11,9,5 pl?*	setae: pld?*

See Table II for definitions of abbreviations.

Although larval morphology of the members of the Mithracidae seems to form a phenetically coherent group, the phylogenetic relationships among them, as well as with other majoideans, is poorly understood. Gore *et al.* (Gore *et al.*, 1982) discussed the phylogenetic relationships among mithracids for which larval morphology was known at that time. More recently, despite the apparent morphological consistency within Mithracidae suggested by Yang (Yang, 1967) and the phylogenetic arrangement proposed by Gore *et al.* (Gore *et al.*, 1982), larval characters were unable to support the monophyly of Mithracidae (Pohle and Marques, 2000). However, Marques and Pohle (Marques and Pohle, 2003) found that the phylogenetic analysis of larval characters in which the monophyly of Mithracidae was enforced did not differ greatly from the initial analysis that resulted in a paraphyletic Mithracidae. The authors concluded that, although the larval data set does not support the monophyly of Mithracidae, its paraphyletic status awaits further larval evidence.

Comparison of *S. furcatus* with previous descriptions for the genus

Comparing the descriptions of Laughlin *et al.* (Laughlin *et al.*, 1984) and Bolaños *et al.* (Bolaños *et al.*, 1994) for *S. furcatus coelatus* from the Caribbean revealed discrepancies that undermined the diagnosis of this species based on larval morphology (Tables V, VI and VII). As an example, for the first zoeal stage Laughlin *et al.* (Laughlin *et al.*, 1984) reported three aesthetascs on the antennule, eight setae on the endopod of the maxillule and seven setae on the basis of the first maxilliped, for which Bolaños *et al.* (Bolaños *et al.*, 1994) observed four aesthetascs, seven and ten setae, respectively. For the second zoeal stage, Laughlin *et al.* (Laughlin *et al.*, 1984) described six aesthetascs on the antennule, eight setae on the endopod of the maxillule and 6, 5–6 setae on the basial endite of the maxilla, but Bolaños *et al.* (Bolaños *et al.*, 1994) found eight aesthetascs, seven setae on the endopod of maxillule and 5, 5 setae on the basial endite of the maxilla. Unfortunately, Laughlin *et al.* (Laughlin *et al.*, 1984) did not describe the megalopa, which impedes further comparison.

The considerable differences between the zoeal descriptions of Bolaños *et al.* (Bolaños *et al.*, 1994) and Laughlin *et al.* (Laughlin *et al.*, 1984) (Tables V and VI) may indicate that these larval accounts are perhaps from two different taxa inhabiting Caribbean waters. In fact, Bolaños *et al.* (Bolaños *et al.*, 1994) suggested that Laughlin *et al.* (Laughlin *et al.*, 1984) had supposedly described the subspecies *S. furcatus furcatus*, an assertion based on the examination of a male specimen collected by a co-author of Laughlin *et al.* (Laughlin *et al.*, 1984). However, only a re-examination of those larval specimens and the spent female would clarify this matter fully. Unfortunately it was impossible to accomplish this, because no specimens were apparently deposited in reference collections, which would make them available to the scientific community.

When comparing our zoeal description with those of Laughlin *et al.* (Laughlin *et al.*, 1984) and Bolaños *et al.* (Bolaños *et al.*, 1994), particularly for those meristic characters for which earlier descriptions differed, it is apparent that the results from Bolaños *et al.* (Bolaños *et al.*, 1994) are almost in full agreement with the present study (Tables V and VI). While there are apparent differences in setal types, this could, for the most part, be explained by specimen preparation and the different quality of the optical equipment used, rather than representing substantive differences.

Table V: Comparison of larval characters of first zoeal stage for descriptions of Stenocionops furcatus (Olivier 1791)

Zoea I	Carapace	Antennule	Maxillule	Maxilla	Mxpd 1	Mxpd 2	Abdomen
Laughlin *et al.* (1984)	6 pl ventral margin	3 ae	cox: 4–5 den, 2 s; bas: 5–6 den, 2 s; end: 2 s, 6s	cox: 4–5 s, 4–5 s; bas: 4*,4–5 den+s; sca: 11 pl	cox: n/d; bas: 7 s; end: 2,2,1,2,5 s*	bas: 3 s*; end: 0,1,4*	S1–S5: 1s
Bolaños *et al.* (1994)	6 pl ventral margin	4 ae, 2 s	cox: 7 set; bas: 6 set; end: 1, 6 set	cox: 4, 4–5 set; bas: 5, 4 set; sca: 11–12 pl	cox: 0; bas: 10 set; end: 3,2,1,2,5 set	bas: 3 s; end: 0,1 set, 3 s+2 set	S1–S5: 2 set
Present study	3 pl, 2 pld ventral margin	4 ae, 2 s	cox: 7 pld; bas: 6 pld, 1 pl; end: 1, 6 pld	cox: 3 pl + 1pld, 3 pl + 2 pld; bas: 5, 4 pld; sca: 10 pl	cox: 1 s; bas: 10 pld; end: 2–3,2,1,2,5 pld	bas: 3 pld; end: 0,1,5 pld	S1: 2 pld; S2–S5: 2 s

See Table II for definitions of abbreviations.

Table VI: Comparison of larval characters of second zoeal stage for descriptions of Stenocionops furcatus (Olivier 1791)

Zoea II	Carapace	Antennule	Maxillule	Maxilla	Mxpd 1	Mxpd 2	Abdomen
Laughlin *et al.* (1984)	n/d	6 ae	cox: 4–5 den, 3–4 s; bas: 7–8 den, 1–2 s; end: 2 s, 6s; exo: n/d	cox: 1den+3–4 s, 1–2 den+3–4 s; bas: 2 den+4 s, 1 den+4–5 s; sca: 19–20 pl	cox: n/d; bas: 8 s; end: 2,2,1,2,5 s*	bas: 3 s*; end: 0,1,4*	S1–S5: 1 s
Bolaños *et al.* (1994)	7–8 ventral margin	8 ae, 2 s	cox: 8 set; bas: 9 sp+1 set; end: 1, 6 set; exo: 1 pl	cox: 4, 4–5 set; bas: 5, 5 set; sca: 21–23 pl	cox: 0; bas: 10 set; end: 3,2,1,2,5 set	bas: 3 s; end: 0,1 set, 3 s+2 set	S1: 3 set; S2–S3: 4 set; S4–S5: 2 set
Present study	6–7 ventral margin	8 ae, 2 s	cox: 7 pld; bas: 8 pld, 2 pl; end: 1, 6 pld; exo: 1 pap	cox: 3 pl + 1pld, 2 pl + 2 pld; bas: 5, 4–5 pld; sca: 19–21 pl	cox: 1 s; bas: 10 pld; end: 2–3,2,1,2,5 pld	bas: 3 pld; end: 0,1,5 pld	S1: 3 pld; S2–S3: 4 s; S4–S5: 2 s

See Table II for definitions of abbreviations.

Table VII: Comparison of larval characters of megalopa for descriptions of Stenocionops furcatus (Olivier 1791)

Megalopa	Antennule	Antenna	Maxillule	Maxilla	Mxpd 1	Mxpd 2	Mxpd 3	Abdomen
Bolaños *et al.* (1994)	ped: 0,1,1 s; end: 0,3s; exo: 9 ae+1 s, 4+1 ae	seg 1–7: 1,2,3,0,0,4,4 s	cox: 10 set; bas: 18 set; end: 2 s; epi: 1 set	cox: 7 set, 3 set; bas: 6 set, 5 set; end: 0; sca: 36–37, 3 s	cox: 8 set; bas: 11–12 set; exo: 1, 4 set; epi: 6 set	end: 0,1,3,6 set; exo: 0, 4 pl	cox: 18 pl; end: 11,9,5, 6,4 set; exo: 6 pl; epi: 5 set	S1: 4 + 2 set; S2–S6: 8,8,8,6,2
Present study	ped: 0,1,2 s; end: 3 s; exo: 10 ae+1 s, 4, 1 ae	seg 1–7: 1,2,3,0,0,4,4 s	cox: 10 pld; bas: 15 pld, 3 pl; end: 2 s; epi: 1 pld	cox: 5 pl+1 pld, 2 pl+1 pld; bas: 6 pld, 5 pld; end: 0; sca: 35–36, 3 s	cox: 8 pld; bas: 11 pld; exo: 1 pap, 4 pl; epi: 5 pld	end: 0,0,1,3, 6–7 pld; exo: 0, 4 pl	cox: 7–8 pl; end: 12,9, 5, 5–6,4 pld; exo: 5 pl; epi: 7–8 pld	S1: 4 + 2 pl; S2–S6: 8,8,8,8,2

See Table II for definitions of abbreviations.

Other zoeal differences, including the number of setae on the ventral margin of the carapace, scaphognathite, and coxa of the first maxilliped (Table V) are known, or likely, to be intraspecifically variable. Overall, we found that zoeae from the present study more closely resemble those described by Bolaños *et al.* (Bolaños *et al.*, 1994), supporting their suggestion that Laughlin *et al.* (Laughlin *et al.*, 1984) possibly described *S. furcatus furcatus*.

Bolaños *et al.* (Bolaños *et al.*, 1994) also provided the first description of the megalopa stage of *S. furcatus coelatus*. There appear to be few substantive differences in comparison to specimens from the present study. Setal meristics of the maxillule are identical and the setation and segmentation of the antennule, considered to be useful differentiating characters (Rice, 1988), are indistinguishable between descriptions. Numbers of setae on the ventral carapace and scaphognathite margins, and antennular aesthetascs either overlap or differ only slightly, and are probably intraspecifically variable, as suggested for other species (Marques *et al.*, 2003). Slight differences in the setation of maxilliped exopods are the result of the reduction and change in function of the former zoeal natatory setae. Other meristic differences on the maxillar

coxa and epipod of maxilliped 1, and endopod of maxilliped 3 are also minor. These could, for example, be differences related to the geographic separation of Caribbean and Brazilian populations.

The only substantial megalopal differences relate to the setation of the coxa of the third maxilliped and the abdomen (Table VII). For the former, Bolaños *et al.* (Bolaños *et al.*, 1994) found many more setae than one would expect from intraspecific variation, even if some of them may be proximal setae of the epipodite. Abdominal setation, considered to be intraspecifically stable, differs by a pair of setae on the fifth somite. Recent findings demonstrate the importance of abdominal setation in identifying Mithracidae (Santana *et al.*, 2003). However, it remains to be determined whether Bolaños *et al.* (Bolaños *et al.*, 1994) may have overlooked these abdominal setae before making further conclusions.

From the above it is evident that the zoeal stages in the present study resemble more those of *S. furcatus coelatus* than *S. furcatus furcatus*, if the assertion of Bolaños *et al.* (Bolaños *et al.*, 1994), that the specimens of Laughlin *et al.* (Laughlin *et al.*, 1984) may represent the former, is correct. While a megalopa was not described by Laughlin *et al.* (Laughlin *et al.*, 1984) to support this assertion further, the megalopa of *S. furcatus coelatus* described by Bolaños *et al.* (Bolaños *et al.*, 1994) is for the most part also very similar to specimens from the present study. This leads to the overall conclusion that larvae from the present study closely resemble those of *S. furcatus coelatus* described by Bolaños *et al.* (Bolaños *et al.*, 1994). Adult morphology confirms this as well, our specimens conforming to *S. furcatus coelatus* as characterized by Rathbun (Rathbun, 1925) and Williams (Williams, 1984). According to these authors, the distribution of this subspecies does not extend south of Caribbean waters, our findings therefore indicating a southerly range extension that includes Brazil. Publications by Melo (Melo, 1996) and Vélez (Vélez, 1977), covering majoid crabs from Brazilian and Colombian waters, respectively, do not recognize the subspecies for this genus and therefore offer no further information in this regard.

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