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Discovery and Morphological Variation of the Caridean Shrimp *Discias atlanticus* Gurney, 1939 (Crustacea: Decapoda: Bresiliidae) Associated with the Polychaete Worm *Chaetopterus variopedatus* (Renier, 1804)

María M. Criales[1] and Rafael Lemaitre[2]

[1]*Rosenstiel School of Marine and Atmospheric Sciences, University of Miami, 4600 Rickenbacker Causeway, Miami, Florida 33149-1098*
mcriales@rsmas.miami.edu
[2]*Department of Invertebrate Zoology, National Museum of Natural History, Smithsonian Institution, Washington, D.C. 20560*
lemaitrr@nmnh.si.edu

Abstract.—Seven specimens of the bresiliid shrimp *Discias atlanticus* Gurney, were discovered in tubes of the polychaete worm *Chaetopterus variopedatus* (Renier), in Bahía de Santa Marta, Colombia. This shrimp had not been previously reported in the southern Caribbean. The polychaete tubes were collected in shallow water (2–10 m) on a muddy bottom containing numerous dead fragments of the coral *Porites porites* (Pallas). The finding represents the first report of *D. atlanticus* in association with an invertebrate, and the highest number of specimens ever reported of this species from one locality. Significant morphological variations related to sex are described in the shape of the rostrum, segmentation of the mandibular palp, and armature of dactyl of fifth pereopod. The Colombian specimens are compared with those from other localities, and the new tubiculous habitat is discussed.

Resumen.—Siete especímenes del camarón bresiliido *Discias atlanticus* Gurney, se encontraron en tubos del poliqueto *Chaetopterus variopedatus* (Renier), en la Bahía de Santa Marta, Colombia. Este camarón no había sido reportado con anterioridad en el Caribe sur. Los tubos del poliqueto fueron hallados en aguas someras (2–10 m), enterrados en un sustrato lodoso con muchos fragmentos muertos del coral *Porites porites* (Pallas). Este encuentro representa el primer caso conocido de *D. atlanticus* viviendo en asociación con un invertebrado, y es el número mas alto de especímenes hasta ahora encontrados en una localidad. Se describen las variaciones morfológicas de importancia ligadas al sexo observadas en el rostro, segmentación del palpo mandibular, y espinas del dactilo del quinto pereópodo. Los ejemplares de Colombia se comparan con especímenes encontrados en otras localidades, y se presenta una discusión del nuevo hábitat tubicular.

Introduction

Shrimp of the genus *Discias* Rathbun, 1902, are characterized by having a strikingly modified dactyl on the first cheliped, which is semicircular, disk-like, and has a razor-sharp cutting edge. Kensley (1983), in his review of the family Bresiliidae, recognized six valid species in this genus, *D. atlanticus* Gurney, 1939, *D. brownae* Kensley, 1983, *D. exul* Kemp, 1920, *D. musicus*, Holthuis, 1981, *D. serratirostris* Lebour, 1949, and *D. serrifer* Rathbun, 1902. Boothe and Heard (1987) described a seventh species, *D. vernbergi*, from the northwestern Atlantic and Fransen (1987) described a eighth species, *D. pascuensis*, from the west coast of Easter Island, Chile.

Discias atlanticus has an unusually wide and disjunct tropical and subtropical distribution. It has been reported in the western Atlantic from Bermuda (Gurney, 1939), Florida (Gore and Wilson, 1978), Guadeloupe (Monod, 1939), Gulf of Mexico and coast of Georgia (Kensley, 1983); eastern Atlantic, near Cape Verde and Gabon (Holthuis, 1951); western Indian Ocean, off northern Kenya (Bruce, 1975); the Red Sea (Williamson, 1970); and Australia's Great Barrier Reef (Kensley, 1983). The wide range of morphological variation observed in specimens reported as *Discias atlanticus* from scattered localities throughout the world, has led carcinologists to suspect that more than one species may be involved (Holthuis, 1951; Kensley, 1983). However, the considerable overlap in the range of variations exhibited by the available mate-

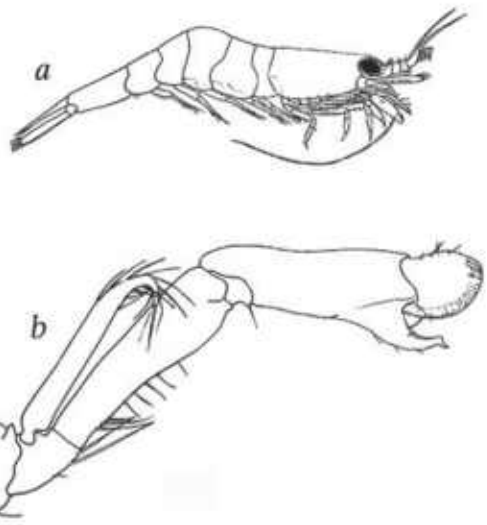

FIG. 1. *Discias atlanticus* Gurney, 1939, male syntype, CL 2.6 mm, Bermuda, USNM 77877: a, lateral view (after Gurney, 1939); b, right first pereopod, lateral view (after Kensley, 1983).

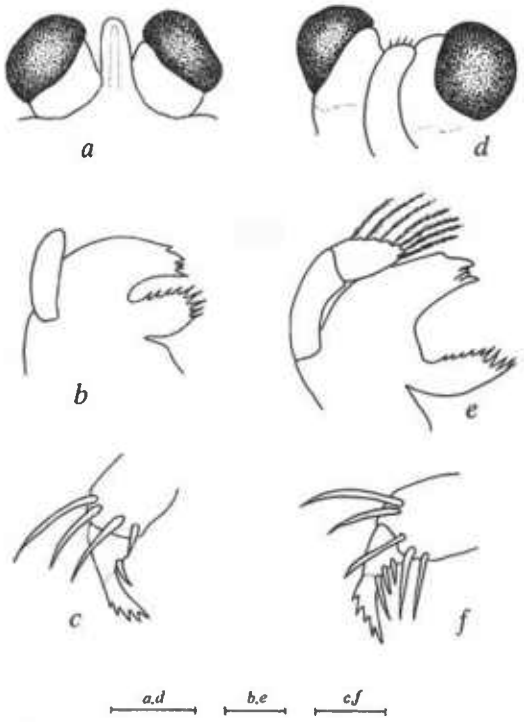

FIG. 2. *Discias atlanticus* Gurney, 1939, El Morrito, Bahía de Santa Marta, Colombia. a–c, Male, USNM 275992: a, Rostrum and anterior part of carapace, dorsal view; b, Mandible; c, Dactyl of fifth pereopod. d–f, Female ovig., USNM 275991: d, Rostrum and anterior part of carapace, dorsolateral view; e, Mandible; f, Dactyl of fifth pereopod. Scales equal 0.5 mm (a,d), and 0.1 mm (b,c,e,f).

rial has presented a problem in defining more than one species.

Information on the biology or habitat of *D. atlanticus* is scarce. Despite its wide distribution only one or two specimens have been found in each locality, and in very different environments. Gurney (1939) found a male and female in the plankton at night, in shallow waters of Bermuda. Bruce (1975) collected two adults using a midwater trawl in the East African Counter Current, at 110 m. Holthuis (1951) collected one male on a foraminifera bottom in the Cape Verde Islands, at 40 m, and another male on mud bottom, at 50 m. Gore and Wilson (1978) obtained two specimens from a multiple-compartment sediment tray off Fort Pierce, Florida, at 33 m.

During faunistic investigations of the Santa Marta region, on the Caribbean coast of Colombia, seven specimens of *D. atlanticus* were discovered living inside several tubes of the polychaete worm *Chaetopterus variopedatus* (Renier). The worms were collected in shallow water in a mud bottom with numerous dead fragments of the coral *Porites porites* (Pallas), by colleagues from the Instituto de Investigaciones Marinas de Punta de Betín (INVEMAR). The discovery of this previously unknown habitat for this shrimp, and the unusually high number of specimens found, prompted us to compare them with material of *D. atlanticus* deposited in the National Museum of Natural History, Smithsonian Institution, Washington, D.C. (USNM). Herein we describe the most important morphological variations observed in our specimens, and provide information on the new habitat. Carapace length (CL) in millimeters, was measured from the level of the posterior margin of the orbit to the middorsal posterior margin of the carapace.

RESULTS

Discias atlanticus Gurney, 1939
Figs. 1, 2

Material Examined.—El Morrito, Bahía de Santa Marta, Colombia (approx. 11° 15'N, 74° 10'W): 6 males, 1 female ovig. (CL 2.2–

2.6 mm), in tubes of the polychaete *Chaetopterus variopedatus*, 2–10 m, June 1980, coll. P. R. Dueñas, USNM 275991, 275992.

Comparative material.—BERMUDA: syntype, 1 male (CL 2.6 mm), The Reach, shallow water, July 1938, USNM 77877. GEORGIA (USA): 1 female ovig. (CL 3.3 mm), off Savannah, 31°51'30"N, 79°30'00"W, 66 m, USNM 190704. FLORIDA (USA): 1 male (CL 2.5 mm), off Fort Pierce, R/V *Sunburst*, 27°28.388'N, 80°04.294'W, in sediment from baited trap, 25 m, 21 April 1993, coll. R. Lemaitre, USNM 276040. BELIZE: 1 male (CL 2.0 mm), off Glover Reef, SW Cays, 12.2 m, 22 March 1980, coll. G. Hendler, USNM 273530.

Diagnosis (modified from Kensley, 1983).—Rostrum longer than basal width, anteriorly rounded; dorsally with faint longitudinal median ridge, margins entire. Abdominal segment 2 lacking middorsal spine on posterior margin. Telson with 3 pairs of spines on posterior margin. Antennal scale with distolateral tooth. Mandibular incisor process distally truncate, toothed; palp unsegmented or 2-segmented. Dactyls of pereopods 3–5 each with multi-dentate dorsodistal margin. Outer uropodal ramus with lateral margin entire.

Distribution.—Western Atlantic: Bermuda; Georgia; Florida; Gulf of Mexico; Guadeloupe; and Colombia (new record). Eastern Atlantic: Cape Verde, Gabon. Western Indian Ocean: Kenya. Red Sea. Eastern Australia. Depth: shallow water to 66 m, rarely to 201 m (Bruce, 1975; Gore and Wilson, 1978; Kensley, 1983; Williams, 1984).

Habitat.—The Colombian specimens were found living inside three tubes of the polychaete worm *Chaetopterus variopedatus*, ranging in length from about 40 to 80 cm. The tubes were extracted from a mud bottom containing numerous dead fragments of the coral *Porites porites*, and brought to the INVEMAR laboratory where the shrimps were discovered. In the study area, these worm tubes are usually found concentrated in groups of about 20, are U-shaped, and have sand grains attached to a parchment-like material on the outer surfaces.

Morphological Variation.—Our specimens generally agree with Gurney's (1939) description of *D. atlanticus*, and exhibit morphological variations similar to those observed by Kensley (1983) in specimens from widely scattered localities. In our specimens, however, we observed pronounced differences between males and females in the shape of the rostrum, mandibular palp, and dactyl of the fifth pereopod.

In the males, the rostrum (Fig. 2a) decreases slightly in width distally, reaching almost to the distal margin of the cornea, and the tip lacks setae; it is dorsoventrally flattened except for a faint median dorsal ridge. The mandible (Fig. 2b) has an unsegmented palp lacking distal setae (except in one male). The fifth pereopod has a short, slender dactyl (Fig. 2c) that can be flexed 180°; the dactyl has five dorsodistal spines, and one median slender spine on the ventral margin; there are four long slender spines on the mesial face of the propodus distally near the articulation with the dactyl. The single female has a narrow rostrum (Fig. 2d) curving ventrally between the ocular peduncles, reaching to about midlength of the peduncles, and the tip has four short setae; there is no indication of a median dorsal ridge. The mandible (Fig. 2e) has a well developed two-segmented spatulate palp, and the distal segment has eight plumose setae distally. The fifth pereopod also has a short, slender dactyl (Fig. 2f) that can be flexed 180°; the dactyl has five dorsodistal spines, and three slender spines on the ventral margin; there are five long, slender spines on the mesial face of the propodus distally near the articulation with the dactyl.

In other morphological features, the Santa Marta specimens generally resemble the Bermuda and other Atlantic material examined, and can be characterized as follows. The endopodite of the third maxilliped is three-segmented [Kensley (1983: fig. 5h), however, depicted a two-segmented condition]; the terminal segment is twisted, with 4–5 long plumose setae on the ventral margin; the dorsal margin has 7–8 short transverse rows of 4–6 stiff denticulate setae. The number of setae on the ischia, meri, carpi and propodi of the third and fourth pereopods are for each segment 2, 5, 1, and 3 respectively; and of the fifth pereopod 2, 3, 1 and 3, respectively. Our ovigerous fe-

male had about 30 large eggs each about 5 or 6 mm in diameter which shown well developed embryos.

Discussion

The wide tropical and subtropical distribution of *D. atlanticus*, and the considerable variation exhibited by this species, has long suggested the possibility that more than one species is involved. Holthuis (1951) observed differences between specimens from Bermuda and Cape Verde. Forest (1977) suggested that Holthuis's specimens of *D. atlanticus* from Gabon and Cape Verde Islands, with a biarticulate mandibular palp, were not conspecific with Gurney's (1939) *D. atlanticus* from Bermuda. Kensley (1983) compared specimens from widely different localities (Bermuda, Florida, Georgia, Gulf of Mexico, Cape Verde, and Australia), and found that the shape of the rostrum and mandibular palp of the specimens from Florida and Bermuda differ from those of the Gulf of Mexico, Georgia, Australia and the eastern Atlantic. Specimens from Bermuda and Florida had an unsegmented mandibular palp, and the rostrum was more rounded anteriorly and wider at the base than in the specimens from Georgia and Gulf of Mexico. Kensley (1983) also described four types of mandibular palps for *D. atlanticus*, and considered that the unsegmented type might be attributable to damage or immaturity. In our Colombian specimens, all of which are mature and undamaged, the palp varies from unsegmented to two-segmented (Fig. 2b,e), suggesting that varying degrees of segmentation may represent intra-specific variations. Such variation is not without precedent among caridean shrimps, as similar variability of the mandibular palp has been reported by Chace (1972) for the palaemonid *Palaemon debilis* Dana, 1852; in this species the palp varies from unsegmented to three-segmented.

In our specimens and in others used for comparison, we have observed marked morphological differences between males and females. It is apparent that morphological variations due to sexual dimorphism are greater than those attributable to geographic or environmental factors. Of the specimens of *D. atlanticus* that we have examined, and of those for which sufficient details are given in the literature (Gurney, 1939; Holthuis, 1951; Kensley, 1983), 77% (10 of 13) of the males have an unsegmented mandibular palp, and 80% (4 of 5) of the females have a two-segmented palp. The differences in rostral shape between males and females seen in our specimens (Fig. 2a,d), seem to be present as well in material of this species reported from other localities, except for a male reported by Holthuis (1951) with a basally narrow rostrum. Additional specimens of both sexes are needed from throughout the range of this species to confirm whether this variability is indeed primarily sex related.

Ecological Remarks.—The polychaete *Chaetopterus variopedatus* commonly builds U-shaped tubes in shallow water environments. The tubes are buried upright in the mud or other sediment, and have a narrow siphon at each end. Although the siphons are narrow, the tubes can be as wide as 4 cm in diameter at the midpoint of the "U" (Gray, 1961). Several crab live in a commensal or opportunistic relationship with this polychaete, using the tubes as housing (Enders, 1905; Pearse, 1913; Gray, 1961; Gore, 1968; Ng and Nakasone, 1993). The most common and best known associates of this polychaete are the porcellanid crab *Polyonyx gibbesi* Haig, 1956, an obligate commensal, and the pinnotherid crab *Pinnixa chaetopterana* Stimpson, 1860, a facultative commensal (Haig, 1956; Gray, 1961; Williams, 1984). It is believed from casual observations that the crabs benefit from their host by obtaining food brought in by the worm, and by the protection afforded by the tube.

Caridean shrimps have not been previously reported living in tubes of *C. variopedatus*. Unfortunately, it was not possible to determine if the presence of our *D. atlanticus* specimens in these tubes was fortuitous, or due to a closer ecological relationship. *Discias exul* and *D. brownae* live in association with sponges (Kemp, 1920; Bruce, 1970, Kensley, 1983), and *D. serratirostris* with the ivory coral *Oculina varicosa* Lesueur (Wilson and Gore, 1979). The discovery of *D. atlanticus* living in tubes of a polychaete represents the fourth type of invertebrate asso-

ciated with species of *Discias*. The remarkable adaptation of the dactyl of the first pereopod in species of *Discias* has suggested a specialized feeding mechanism and mode of life (Bruce, 1970; Kensley, 1983). Perhaps these shrimps use the razor-sharp edges of the dactyls for scraping food particles from the mucous-lined walls of the tubes, which are rich in detritus and bacteria. The finding in the Santa Marta region of an unusually high number of specimens of *D. atlanticus* living in tubes of *C. variopedatus*, also suggests that *D. atlanticus* might use this habitat more frequently than others previously reported.

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