Crustaceans associated with Cnidaria, Bivalvia, Echinoidea and Pisces at São Tomé and Príncipe islands

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Wirtz, P. & C. d'Udekem d'Acoz 2008. Crustaceans associated with Cnidaria, Bivalvia, Echinoidea and Pisces at São Tomé and Príncipe islands. *Arquipélago*. Life and Marine Sciences 25: 63-69.

Symbiotic crustaceans were searched for at sea anemones (Actiniaria), encrusting anemones (Zoantharia), horny coral (Gorgonaria), black coral (Antipatharia), bivalves (Bivalvia), and sea urchins (Echinoidea) at São Tomé and Príncipe Islands (Gulf of Guinea, eastern central Atlantic). Sixteen species of crustaceans were found in association with these invertebrate hosts; eleven of them were new records for the area and two species, belonging to the genera *Hippolyte* and *Heteromysis*, were new for science. The thalassinid *Axiopsis serratifrons* was occasionally associated with an undescribed species of gobiid fish.

Key words: Decapoda, eastern central Atlantic, Mysidacea, symbiosis

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INTRODUCTION

Caridean shrimps are common associates of invertebrates such as sea anemones, black coral, horny coral, bivalves, and sea urchins in tropical and subtropical waters (e.g. Criales 1984; Gherardi 1991; Fransen 1994a; Spotte et al. 1995; Goh et al. 1999; Baeza 2008). A survey of black coral at Madeira, the Azores, the Canary islands, and the Cape Verde islands resulted in the discovery of new species of caridean shrimps (Wirtz & d'Udekem d´Acoz 2001). The sea anemone *Telmatactis cricoides* harbours 19 different species of crustaceans at Madeira Island (Wirtz 1997; Wittmann 2008). Large bivalves frequently contain shrimps of the genus *Pontonia* (Fransen 1994b, in review) and a survey of bivalves at the Cape Verde islands revealed *Pontonia* species new for the area and new for science (Wirtz & d'Udekem d´Acoz 2001). The presence of crustaceans associated with invertebrate hosts could therefore also be expected for the islands of São Tomé and Príncipe (Gulf of Guinea, eastern central Atlantic) and such associations were searched for during three expeditions in August 2002, February-March 2004, and February 2006.

MATERIAL AND METHODS

Observations were made while SCUBA diving in the area of Bom Bom islet on the north coast of Príncipe Island, and around São Tomé Island in a depth range of 0 – 60 m. The geographic locations of the sampling sites were as follows:

A) Príncipe Island: Bom Bom islet 01º41'N - 07º24'E; Pedra da Galé 01º43'N - 07º22'E; Mosteiros 01º41'N - 07º28'E.
B) São Tomé Island: Ilhéus Cabra 00º25.226'N – 06º42.000'E; Kia 00º25.237'N – 06º41.698'E;

Lagoa Azul 00º24.377'N – 06º36.602'E; Diogo Vaz 00º18.891'N – 06º29.358'E; Santana Islet 00º14.554'N – 06º45.601'E; Sete Pedras 00º02.505'N – 06º37.543'E; Rolas islet 00º00.208'N – 06º31.436'E. Crustaceans were collected with a small hand-held aquarium net. Some of the species were photographed *in situ*. Most specimens are now deposited in the collections of Royal Belgian Institute of Natural Sciences, Brussels under the registration number I.G. 31097. *Thor amboinensis* and *Rapipontonia platalea* are in the Nationaal Natuurhistorisch Museum at Leiden, Netherlands, under the numbers RMNH D 50697 and RMNH D 50047/50048. See d'Udekem d´Acoz (2007) for specimen data of the two *Hippolyte* species.

RESULTS

Associations with Actiniaria

Telmatactis cricoides (Duchassaing, 1850)
This large sea anemone was occasionally encountered at São Tomé and Príncipe, from 0.5 to 46 m depth. The association of the shrimp *Thor amboinensis* (De Man, 1888) with *Telmatactis cricoides* at Príncipe has already been recorded by Wirtz (2004), who also noted the presence of the cleaner shrimp *Lysmata grabhami* (Gordon, 1935) at Príncipe. These two shrimp species, which live on both sides of the Atlantic, were encountered in association with *T. cricoides* not only at Príncipe Island but also at São Tomé Island. Colour photos of both species associated with *Telmatactis cricoides* (at Madeira Island) are given by Wirtz & Debelius (2003).

A ball shaped dense aggregation of at least 30 individuals of an undescribed species of *Heteromysis* (Crustacea, Mysidacea) hovered directly over the oral disk of a *T. cricoides* at 46 meters depth, at Diogo Vaz. Specimens were sent to K. Wittmann, who will describe the species.

Actinostella flosculifera (Lesueur, 1817)
The sea anemone *Actinostella flosculifera* is common at São Tomé and Príncipe from tide pools down to at least 25 m depth (Wirtz 2003). It forms warty disks of up to 10 cm diameter. About 20 individuals of this sea anemone were visually searched for associated crustaceans; none were encountered.

Associations with Zoantharia

Palythoa caribaeorum Duchassaing de Fonbressin & Michelotti, 1860
The zoanthid *Palythoa caribaeorum* forms large dense mats in the intertidal and down to at least 15 m depth. The small crab *Platypodiella picta* (A. Milne-Edwards, 1869) was common in pockets formed by zoanthid mats at low tide level at Bom Bom islet, Príncipe. The species has been recorded in association with various zoanthid species, from the Gulf of Guinea to Madeira Island (d'Udekem d'Acoz 1999; Araújo & Freitas 2003).

Associacions with Gorgonaria

Horny coral are plentiful at São Tomé and Príncipe at places exposed to moderate currents. Small red, blue, yellow and white gorgonians in about five to 15 m depth were not collected and could therefore not be identified. Below the thermocline, at about 30 m depth (in February 2004), large gorgonians of many different colours formed veritable forests. Branches of some of the large gorgonians from which decapods were collected were preserved together with the crustaceans and sent to an expert for identification (see Acknowledgements). Large red and blue gorgonians growing below 10 m depth turned out to be *Muriceopsis tuberculata* (Esper, 1792) and large orange to yellow gorgonians below 10 m depth belong to the genus *Leptogorgia* and probably to the species *L. gaini* (Stiasny, 1940).

From unidentified small blue and white gorgonians in 14 m depth at Rolas islet, the two shrimp species *Rapipontonia platalea* (Holthuis, 1951) and *Latreutes* cf *parvulus* (Stimpson, 1866) were collected. *Rapipontonia platalea* was also collected from unidentified large gorgonians at Rolas islet in 26 m depth and from unidentified large gorgonians in 21 m depth at Sete Pedras and in 45 m depth at Pedra da Galé.

From *Leptogorgia* in 10 m depth at Mosteiros the shrimps *Rapipontonia platalea* and *Pseudo-coutierea wirtzi* d'Udekem d'Acoz, 2001 were

collected, including ovigerous females of both species (Figs. 1 and 2). *Hippolyte longiallex* d'Udekem d'Acoz, 2007 were collected from *Muriceopsis tuberculata* in 35 m depth at Pedra da Galé, including ovigerous females.

One male and two ovigerous females of *Hippolyte longiallex* were collected from unidentified large gorgonians in 35 m depth at Diogo Vaz, together with ovigerous females of *Hippolyte* sp. group *varians* and one *R. platalea*.

Rapipontonia platalea is known from the Cape Verde islands, from Guinea and from São Tomé and Príncipe in the Eastern Atlantic and from Tobago in the Western Atlantic (Wirtz 2003; Hale & De Grave 2007). Wirtz & d'Udekem d'Acoz (2001) noted that it lives in symbiosis with black coral and gorgonians, while Hale & De Grave (2007) found it on a hydroid encrusted with a zoantharian. The *Latreutes* specimens agree with the account of *L. parvulus* given by Holthuis (1951) but their scaphocerites are distinctly narrower. *Latreutes parvulus* is known from the West Atlantic (North Carolina to Rio de Janeiro) and from West Africa in "sponges among shells, dead coral, hydroids, and on seagrass flats" (Williams 1984); being reported here from the Gulf of Guinea for the first time. Wirtz & d'Udekem d'Acoz (2001) recorded *Pseudocoutierea wirtzi* from Gorgonaria and from the whip coral *Stichopathes lutkeni* Brook, 1889 at the Cape Verde islands; the known distribution of this species is now extended to São Tomé and Príncipe. The two *Hippolyte* species were undescribed at the time of capture and have since been described by d'Udekem d´Acoz (2007).

ASSOCIATIONS WITH ANTIPATHARIA

Stichopathes lutkeni Brook, 1889

Six whip coral were searched visually and by sliding their length between fingers at Rolas islet in 25 m depth and about 20 more whip coral were searched in the same way at Pedra da Galé and at Diogo Vaz in about 30 m depth; no associated decapods were encountered.

Species similar to *Tanacetipathes spinescens* (Gray) var. *minor* Brook, 1889

In 45 m depth at Pedra da Galé bushes of a black coral resembling *Tanacetipathes spinescens* (Gray) var. *minor* Brook, 1889 were common. Two juveniles of *Hippolyte* sp. group *varians* were collected from two bushes of this antipatharian; they are described by d'Udekem d'Acoz (2007).

Antipathes gracilis Gray, 1860

In 45 m depth at Pedra da Galé and in 45 m depth at Diogo Vaz, small bushes of this densely branched greenish black coral (resembling a hydrozoan at first sight) were encountered.

At Pedra da Galé, the following shrimp species were collected from this antipatharian: *Periclimenes wirtzi* d'Udekem d'Acoz, 1996 (many specimens); *Periclimenes* group *amethysteus* (two specimens, one damaged; with this limited material and without information on colour pattern they cannot be determined to the species level); *Rapipontonia platalea* (one specimen); *Pontoniinae* n. det. (1 specimen, anterior legs missing), *Balssia gasti* (Balss, 1921) (two specimens), *Eualus cranchii* (Leach, 1817) (1 ovigerous female).

At Diogo Vaz, the shrimps *Periclimenes wirtzi* and an unidentified Pontoniinae (perhaps a juvenile *Palaemonella atlantica*) were collected from the same antipatharian species.

Periclimenes wirtzi has previously been reported from black coral at the Azores, Madeira, the Canary islands, and the Cape Verde islands (Wirtz & d'Udekem d'Acoz 2001); a colour photo of this species is given in Wirtz & Debelius (2003). *Balssia gasti* is known as an associate of various anthozoans and sponges in the western Mediterranean Sea and in the eastern Atlantic from the Azores to Guinea (Wirtz & d'Udekem d'Acoz 2001); several colour photos of this species are given in Wirtz & Debelius (2003). *Eualus cranchii* is a free-living species known from Norway to West Africa and here reported from the Gulf of Guinea for the first time.

ASSOCIATIONS WITH BIVALVIA

Spondylus sp.

Three large *Spondylus* (the common species at São Tomé Island, presumably *Spondylus senegalensis* Schreibers, 1793) were opened in a

depth range of 20 to 25 m at Rolas islet and a further eleven *Spondylus* at Lagoa Azul, between 5 and 15 m depth. None of them contained symbiotic shrimps.

Pseudochama sp.
Three bivalves of the family Chamidae, probably the species *Pseudochama radians* (Lamarck, 1819), were opened at Lagoa Azul and a further six at Rolas islet and at Kia. None of them contained symbiotic shrimps.

Pinna rudis Linné, 1758
More than 20 *Pinna rudis* were visually checked (by looking into the gap between the valves of the living mussel) while SCUBA diving at a depth range of 5 – 20 m at Príncipe and São Tomé Islands. At least one, usually two, *Pontonia pinnophylax* (Otto, 1821) were seen in every one of them. Ten *Pinna rudis* were opened at Lagoa Azul and either a male-female pair (8 cases) or a single female (two cases) of *Pontonia pinnophylax* were found in each of them. The species, which is common in the Eastern Atlantic and the Mediterranean, apparently was not yet recorded from São Tomé and Príncipe (Fransen 2002). A colour photo of a pair of *Pontonia pinnophylax* from the Azores was published in Wirtz & Debelius (2003).

Ostrea sp.
Thirteen animals of a common, large, white, intertidal oyster were opened at Rolas islet. No crustaceans were found in them.

ASSOCIATIONS WITH ECHINOIDEA

As noted previously (Wirtz 2004), the shrimp *Tuleariocaris neglecta* Chace, 1969 was found on the sea urchin *Diadema antillarum* Philippi, 1845 at Bom Bom islet, Príncipe, in 10 m depth.

ASSOCIATIONS WITH PISCES

The thalassinid *Axiopsis serratifrons* (A. Milne-Edwards, 1873) builds tunnels on coarse bottoms from 10 m depth down to at least 30 m depth at São Tomé and Príncipe. Near Bom Bom islet and near Diogo Vaz, some of these tunnels were also inhabited by an undescribed gobiid fish of the genus *Didogobius* (Wirtz 2005; Wirtz et al. 2007). The goby is currently being described by Schliewen and Kovačić.

DISCUSSION

Two undescribed species and eleven species not yet recorded in the Gulf of Guinea were found in this survey of symbiotic crustaceans.

Associations with sea anemones were previously reported from three species of the mysid genus *Heteromysis* from the (sub)tropical W. Atlantic: the Caribbean *H. actiniae* Clarke, 1955 appears to be an obligatory commensal of the anemone *Bartholomea annulata* (Sueur, 1817), whereas *H. bermudensis* G. O. Sars, 1885 and *H. mayana* Brattegard, 1970 show facultative associations with anemone species (references in Wittmann 2008). *Heteromysis wirtzi* appears to be an obligate associate of the sea anemone *Telmatactis cricoides* at Madeira Island (Wirtz 1997, Wittmann 2008); in contrast to the *Heteromysis* species that is associated with the same sea anemone at São Tomé Island, it never hovers over the oral disk of the anemone; instead, it circles around the trunk of the sea anemone.

In the Cape Verde islands, bivalves of the genera *Spondylus* and *Pseudochama* contain symbiotic shrimps of the genus *Pontonia* (Wirtz & d'Udekem d'Acoz 2001; Fransen 2002) and the crab *Nepinnotheres viridis* Manning, 1993 can be found in *Pseudochama radians* (Wirtz unpublished). It therefore comes as a surprise that no symbiotic decapods were found in these bivalve species at São Tomé and Príncipe islands.

Periclimenes wirtzi has now been found from the Azores to the equator, always on *Antipathella* and *Antipathes* species; it appears to be a specialist for bushy black coral.

As pointed out previously, it appears to be the size and density of the host species that determines the social structure of the symbiont (Dellinger et al. 1997; Thiel & Baeza 2001; Wirtz & d'Udekem d´Acoz 2001; Thiel et al. 2003). Very small hosts harbour single animals, as is the case of *Pontonia* species in *Pseudochama* and in *Spondylus*. Larger but defendable hosts are often occupied by a pair of associates (e.g. Knowlton 1980; Dellinger et al. 1997; Baeza 2008), whereas

Fig. 1. *Rapipontonia platalea* on *Leptogorgia*, at Mosteiros, Príncipe Island.

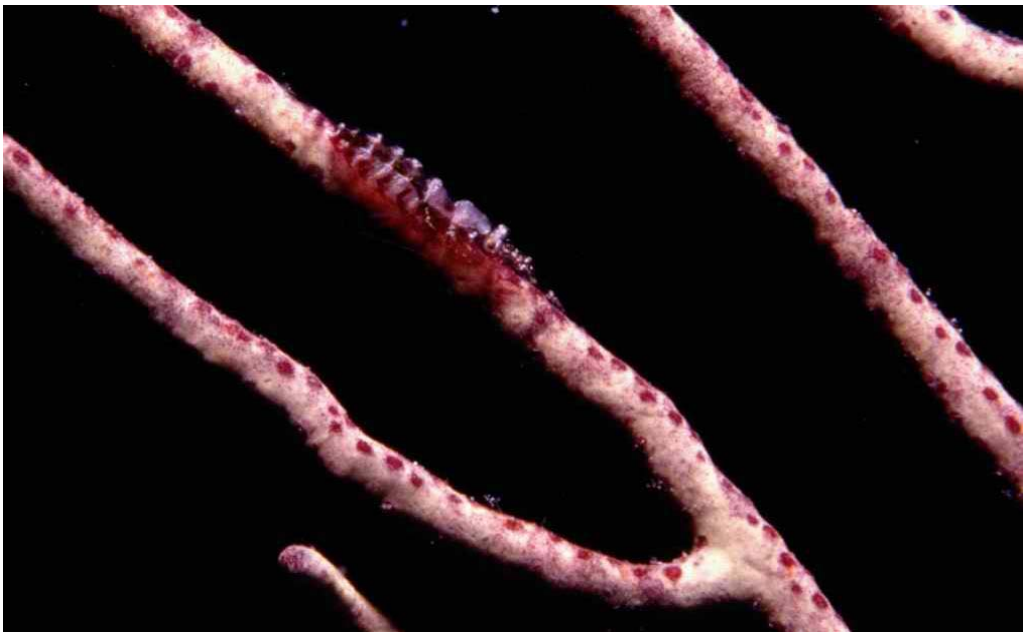

Fig. 2. *Pseudocoutierea wirtzi* on *Leptogorgia*, at Mosteiros, Príncipe Island.

the same species may live in groups of several adult and juvenile animals on still larger organisms (Dellinger et al. 1997; Wirtz & d'Udekem d´Acoz 2001).

ACKNOWLEDGEMENTS

The first author is very grateful to his travel- and diving-companion Karl Wittmann (who also carried a large part of the financial cost of the expedition to Príncipe) for all his help and his friendship. The National Geographic Society sponsored the 2006 expedition to São Tomé (grant number 7937-05 to Sergio Floeter). The Centro de Ciências do Mar (CCMAR) partially financed three trips by the first author to São Tomé and to Príncipe. The Direcção das Pescas of the Republic of São Tomé and Príncipe gave research and collection permits. Angus Gascoigne was of great help on São Tomé Island. Manfred Grasshoff of the Senckenberg Institute in Frankfurt, Germany, identified the gorgonians. Dennis Opresco commented on photos of the Antipatharia. Jean Louis Testori and his crew of Clube Maxell made SCUBA dives at São Tomé Island possible. Many thanks also to Jannie and Cecilia Fourie, the managers of Bom Bom Resort, and their staff for their kindness and support. Peter Dworschak of the Natural History Museum at Vienna identified *Axiopsis serratifrons*; Ulrich Schliewen and Marcelo Kovačić commented on the identity of the goby species. Sammy De Grave and Ivan Marin commented on an early draft of the manuscript. Many thanks to all of them!

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Accepted 2 July 2008.