

First record of *Xenobalanus globicipitis* (Cirripedia: Coronulidae) on *Stenella coeruleoalba* (Cetacea: Delphinidae) in the oligotrophic waters of north-eastern Brazil

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The present contribution reports for the first time the sessile barnacle Xenobalanus globicipitis as an epizoic of the striped dolphin Stenella coeruleoalba in the oligotrophic waters of north-eastern Brazil. One barnacle specimen was found on a dead cetacean in Ceará State, north-eastern Brazil. Diagnosis and figures of the barnacle are provided and the relationship between the epizoic and the host discussed.

Keywords: sessile barnacle, *Xenobalanus globicipitis*, striped dolphin, *Stenella coeruleoalba*, epizoic, western Atlantic

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INTRODUCTION

Several species of cetaceans are known to host sessile barnacles (Cirripedia) and several instances of association between cetaceans and cirripeds have been reported. The degree to which barnacles have adapted to living on cetaceans varies. The stalked barnacles of the genera *Conchoderma* and *Lepas* (family Lepadidae) can be considered generalists because they occur on both living organisms (turtles, cetaceans, etc.) and inanimate objects (ship hulls and floating items) (Aznar *et al.*, 1994). In contrast, other species such as those of the genera *Coronula*, *Cryptolepas*, *Tubicinella*, and *Xenobalanus* (family Coronulidae) are highly specialized to live on cetaceans (Clarke, 1966; Aznar *et al.*, 1994; Seilacher, 2005) and it has been suggested that its hermaphroditic reproduction may be synchronized with that of its host (Dollfus, 1968).

In general, these crustaceans are found as epizoic attached on the body of the mammals. Although some barnacles are not true ectoparasites as they do not feed on cetacean skin or body fluids, they could become abundant enough to increase drag and affect hydrodynamics, reducing the mobility and physiology of their hosts (Aznar *et al.*, 1994; Felix *et al.*, 2006).

The monotypic barnacle *Xenobalanus globicipitis* is specialized for living as a commensal on dolphins and whales (Darwin, 1854), being reported on about 34 species of cetaceans of both temperate and tropical waters (Rajaguru &

Shantha, 1992; Kane *et al.*, 2008). In Brazil, Siciliano *et al.* (1988) and Di Benedetto & Ramos (2000) found *X. globicipitis* on the coast of Rio de Janeiro attached on the Risso's dolphin *Grampus griseus* and on three species of small cetaceans (*Sotalia fluviatilis*, *Pontoporia blainvillei* and *Tursiops truncatus*), respectively. Young (1991) reported *X. globicipitis* found attached on *Sotalia guianensis* on the coast of São Paulo and Engel (1994) observed the presence of this barnacle in a sperm whale *Physeter macrocephalus* on the coast of Bahia.

Besides on the Brazilian coast, only seven previous records of *X. globicipitis* in the western Atlantic are known to date: in Florida on the short-finned pilot whale as a host (Spivey, 1977), on the central Atlantic Coast, USA and in North Carolina on the bottlenose dolphin *Tursiops truncatus* (True, 1891; Mead & Potter, 1990), in North Carolina, on the goosbeaked whale *Ziphius cavirostris* (Bane & Zullo, 1980), in New Jersey, on *T. truncatus* (Gittings *et al.*, 1986; Toth-Brown & Hohn, 2007), in the Gulf of Mexico, on the clymene dolphin *Stenella clymene* (Jefferson *et al.*, 1995), and on the coast of Uruguay, on the franciscana dolphin *Pontoporia blainvillei* (Brownell, 1975). This contribution aims to report for the first time the presence of *X. globicipitis* on the striped dolphin *S. coeruleoalba* in the oligotrophic waters of north-eastern Brazil.

MATERIALS AND METHODS

An adult female striped dolphin *Stenella coeruleoalba*, measuring 2.17 m (Figure 1), was found stranded alive on Manibu Beach, Icapuí (So4°48'06.6" W37°16'00.8"), Ceará

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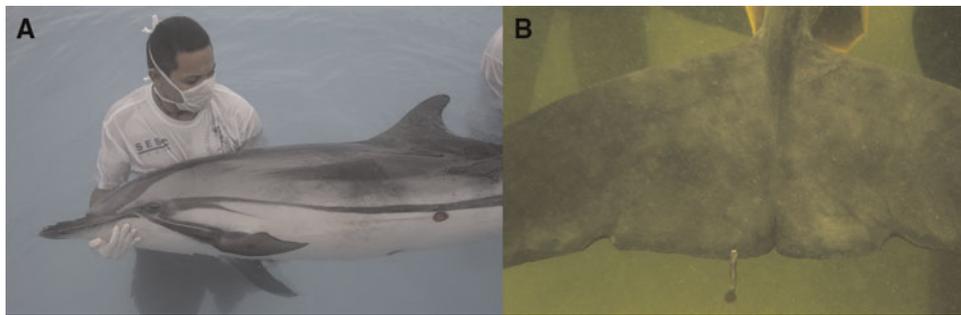


Fig. 1. (A) Striped dolphin *Stenella coeruleoalba* (Meyen, 1833) (Cetacea: Delphinidae); (B) *Xenobalanus globicipitis* Steenstrup, 1852 (Cirripedia: Coronulidae) attached on caudal fluke.

State, north-eastern Brazil (Figure 2). The dolphin was examined for external parasites and one specimen of *Xenobalanus globicipitis* was found attached on caudal fluke. The barnacle was collected and preserved in ethanol (70%) for further analysis. The identification was done following Darwin (1854) and Pilsbry (1916) and the material was deposited in the carcinological collection of the Instituto de Ciências do Mar (LABOMAR), Universidade Federal do Ceará (LABOMAR#707), Fortaleza, Ceará, Brazil. Measurements of total length (TL), width of the body (WB), width of basal plate (WBP), and width of hood (WH) were done using a Vernier caliper (± 0.01 accuracy). The classification adopted in the present contribution follows Martin & Davis' (2001) proposed scheme to family level.



Fig. 2. Presently known range of the sessile barnacle *Xenobalanus globicipitis* Steenstrup, 1852 (Cirripedia: Coronulidae) in the western Atlantic Ocean.

RESULTS

Classification

Order SESSILIA Lamarck, 1818
 Suborder BALANOMORPHA Pilsbry, 1916
 Family COROLUNIDAE Leach, 1817
 Genus *Xenobalanus* Steenstrup, 1852
Xenobalanus globicipitis Steenstrup, 1852
 (Figure 3)

Xenobalanus globicipitis Steenstrup (1851): 62; (1852); Darwin (1854): 440, pl. 17, figures 4a, c.; Cornwall (1927): 510; Stubbings (1965): 902; Young (1991): 194, figures 1d,e; 1998: *Siphonicella* (*sine descript.*) Darwin (1852): 156

MATERIAL EXAMINED

One specimen, Brazil, Ceará State, Manibu Beach, Icapuí on *Stenella coeruleoalba*, coll. Katherine Fiedler Choi, 12 February 2007. TL = 26 mm; WH = 4.6 mm; WB = 3.4 mm; WBP = 4.9 mm.

DIAGNOSIS

Shell thin, small, white, irregularly star-shaped, in an almost rudimentary condition, containing only the basal parts of the animal. Connected to this thin, star-shaped shell is a cylindrical, smooth, flexible, peduncle-like body. It is narrow in the region coming out of the central cavity of the animal. At the distal end of this greatly elongated pseudopeduncle is a reflexed hood, which bears two stumpy outpushings or 'horns,' and hence is broader, and this has the appearance of forming a capitulum, but terga and scuta are absent. Cirri, mouth, a probosciform penis, and associated organs project from the reflexed hood. The wall plates of this barnacle are embedded in the skin of the dolphin, with feeding appendages (cirri) and associated organs suspended by the long fleshy stalk.

REMARKS

Although belonging to the sessile group Cirripedia, this barnacle closely resembles stalked barnacles, especially *Conchoderma auritum* which is also found on cetaceans, though in general, never attached directly to the skin of its host. On the other hand, *Xenobalanus globicipitis* is always attached directly to the skin of its host (Pilsbry, 1916; Barnard, 1924). The genera *Coronula*, *Platylepas*, and *Tubicinella* are morphologically closely related to *Xenobalanus* (Darwin, 1854; Pope, 1958).

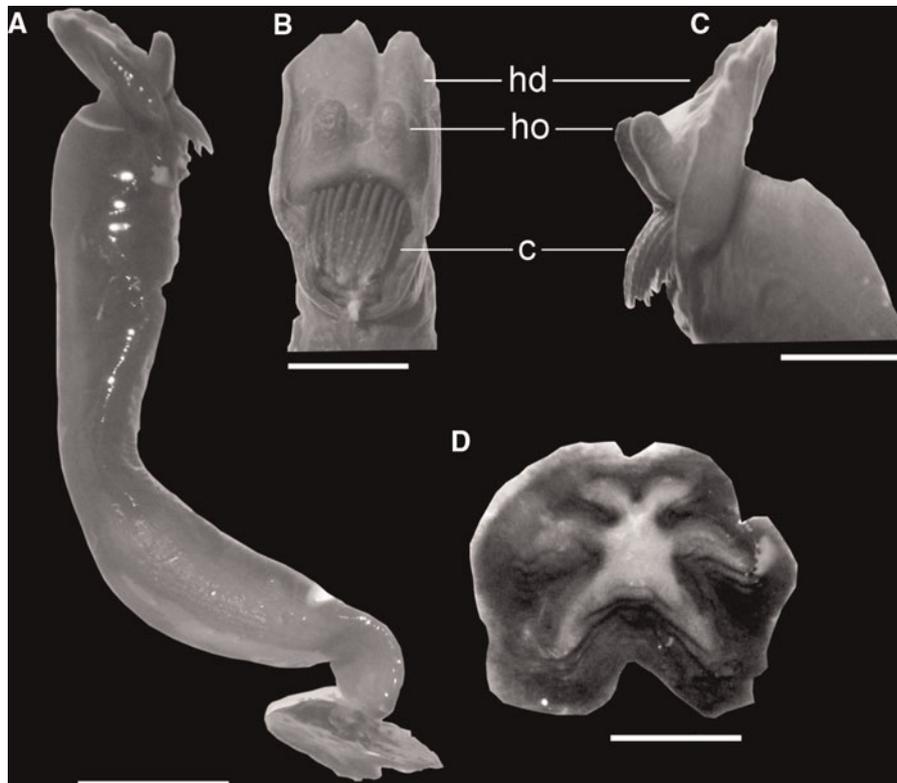


Fig. 3. *Xenobalanus globicipitis* specimen from north-eastern Brazil, collected on the striped dolphin *Stenella coeruleoalba*. (A) Lateral view of the specimen; (B, C) detail of hood (hd), horn (ho) and cirri (c); (D) shell. Scale bars: A = 0.5 mm; B–D = 0.25 mm.

DISCUSSION

Xenobalanus globicipitis and a host, the striped dolphin *Stenella coeruleoalba*, have been previously recorded from the Mediterranean Sea by Raga *et al.* (1982; 1983), South Africa by Ross (1984) and in the eastern tropical Pacific by Kane *et al.* (2008). This specimen seems to be the most abundant and persistent epizoic living on striped dolphin (Aznar *et al.*, 1994).

Rajaguru & Shantha (1992) considered mature barnacle specimens with 30–39 mm of total length, while Aznar *et al.* (1994) estimated the age based on shell diameter and found a large young population (shell diameter < 4 mm) on striped dolphin in the Spanish Mediterranean. We found a subadult specimen (TL = 26 mm; WBP = 4.9 mm) on a living, pregnant and sick animal, suggesting that the cetacean was infected soon before its death.

In general, *X. globicipitis* apparently prefers to attach on sick animals once they present slow movements and immunity (Brody, 1989; Aguilar & Raga, 1993; Aznar *et al.*, 2005). The animal in this study was pregnant and had an abortion in rehabilitation facilities. During the necropsy signs of septicaemia were observed. Considering the gestation and disease, it is possible to affirm that the dolphin was severely immunosuppressed. Aznar *et al.* (1994) found a high concentration of *X. globicipitis* on diseased striped dolphins. Thus, the cetacean swimming speed is an important factor in *X. globicipitis* settlements, as suggested by Orams & Schuetze, (1998). However, Kane *et al.* (2008) pointed out that the swimming speed of the cetacean could not be a primary factor in host species selection, once they found a great intensity of *X. globicipitis*

on the blue whale, a species that sustains cruising speeds up to 33 km/hour.

The striped dolphins are usually found outside the continental shelf, often associated with convergence zones and upwelling waters (Ross, 1984; Archer & Perrin, 1999). This behaviour typically favours the filter-feeding barnacle and reports of high infestation have been made associated with upwelling areas (van Waerebeek *et al.*, 1993; Orams & Schuetze, 1998; Kane *et al.*, 2008). The previous records of *X. globicipitis* along the Brazilian coast were collected in areas of high primary production, on the coast of São Paulo, Rio de Janeiro and Bahia States (Siciliano *et al.*, 1988; Young, 1991; Di Benedetto & Ramos, 2000); however, the waters of the north-eastern Brazilian coast are oligotrophic (Boltovskoy, 1981) and the occurrence of this cetacean species in the region could be accidental, due to the health conditions of the animal. In fact, Kane *et al.* (2008) did not find *X. globicipitis* on the deep-diving species *Physeter macrocephalus* (sperm whale) and *Mesoplodon* spp. (beaked whales) in the eastern tropical Pacific, suggesting that the dive depth of the host may limit the settlement of the barnacle, probably due to the presence of oligotrophic waters in high depth.

In the present contribution, the *X. globicipitis* was found on an adult striped dolphin with age estimated as 22 years, based on counting of dentine layer groups. Striped dolphins are estimated to live for as long as 58 years (Jefferson *et al.*, 2008). Orams & Schuetze (1998) found a statistically significant difference between subadult and adult number of barnacles attached on the bottlenose dolphin *Tursiops truncatus*, being more prevalent on the young (smaller) specimens. In the

same way, Rajaguru & Shantha (1992) reported the presence of *X. globicipitis* only in small bottlenose dolphins. Probably, the barnacle prefers young animals because they may have skin features which allow an easier attachment of the *X. globicipitis* larvae such as low immunity and movement (Orams & Schuetze, 1998). On the other hand, Aznar *et al.* (1994) found no significant difference between prevalence and intensity of infection and dolphin age/size in striped dolphins, showing that the dolphin size has no influence on the prevalence and rate of colonization by this epizoic (Aznar *et al.*, 2005).

Xenobalanus globicipitis has been reported on 34 cetacean species worldwide and has a prevalence ranging from 0.5% to 55% of individuals in each sighting (Aznar *et al.*, 2005). We found only one specimen attached on the dolphin. However, intensity is highly variable, and there are some reports greater than 100 barnacles on a single host (Kane *et al.*, 2008). Aznar *et al.* (2005) reported two striped dolphins with more than 100 barnacles attached, while the greatest intensity observed by Kane *et al.* (2008) was only seven, on killer whale (*Orcinus orca*); although the last authors pointed out that their results could be underestimated due to the photographic method used.

According to Kane *et al.* (2008), the fact that *X. globicipitis* has been reported on 34 cetacean species in both coastal and offshore waters, from the Arctic to Antarctic, could indicate that the barnacle is extremely cosmopolitan (Newman & Ross, 1976; Spivey, 1981), or may suggest that more than one species of the genus *Xenobalanus* is involved. Moreover, this fact suggests an apparent lack of specialization, which may indicate, according to Kane *et al.* (2008), that its evolution and relationship with cetaceans may be more recent than that of other cetacean commensals, and also that its specialization to host species has not yet occurred. This is the first record of the *X. globicipitis* as an epizoic of *Stenella coeruleoalba* in the oligotrophic waters from north-eastern Brazil, filling a gap of distribution between Texas, the Gulf of Mexico and Bahia, Brazil.

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