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NEW HOST RECORD FOR *Livoneca redmanni* (LEACH, 1818) (ISOPODA: CYMOTHOIDAE) IN THE BRAZILIAN COASTAL WATERS WITH ASPECTS OF HOST-PARASITE INTERACTION*

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Cymothoids are among the largest parasites of fishes. These are the isopods commonly seen in numerous families and species of fishes of commercial importance, in tropical and subtropical waters, attached on the body surface, in the mouth or on the gills of their hosts (BRUSCA, 1981; BUNKLEY-WILLIAMS; WILLIAMS, 1998; LESTER; ROUBAL, 2005). Some cymothoids form pouches in the lateral musculature of few freshwater and marine fishes; are highly host and site specific (BRUSCA, 1981; BUNKLEY-WILLIAMS; WILLIAMS, 1998). They are protandrous hermaphrodites which are unable to leave their hosts after becoming females. All gravid females posses a marsupium or brood pouch on the ventral surface of the body, within which the young are held until they become manca, and there is no larval stage (BULLAR, 1876; BUNKLEY-WILLIAMS; WILLIAMS , 1985, 1998. WILLIAMS; WILLIAMS, 1998,). The mancae have only six pairs of legs (compared to seven in juveniles and adults), large compound eyes and pleopods with setae with which they swim very rapidly. After a short free-swimming period they need to find a host fish to take the first meal within one to two days or they die (LESTER, 2005). Like most isopods, cymothoids are considered to feed principally on host blood, but they may consume the mucus, epithelium and subcutaneous tissues of their hosts (LANZING; O'CONNOR, 1975; GRABDA, 1991; LESTER; ROUBAL, 1995; BUNKLEY-WILLIAMS; WILLIAMS, 1998, RAMDANE et. al., 2007).

The species *Livoneca redmanni* (Leach, 1818) has been found only on cero, *Scomberomorus regalis* and serra Spanish mackerel, *S. brasiliensis* (Osteichthyes: Scombridae), in pairs in the gill-chamber. *L. redmanni* causes extreme damages to these fishes and can kill them, causing significant loss of these valuable fishes. *L. redmanni* occurs in the Caribean and the South American coasts to Rio de Janeiro, Brazil (WILLIAMS; BUNKLEY-WILLIAMS, 1996).

The fish *Chloroscombrus chrysurus* (Linnaeus, 1766) (Osteichthyes: Carangidae), commonly known as Atlantic bumper, has a wide distribution range along the shallow Brazilian tropical waters, mainly in bays and estuarine areas. in the western atlantic there are records of this species from Massachusetts, USA, to Northern Argentina. This species is very common in Brazilian Southeast region where they reach a total body length of 300 mm (MENEZES; FIGUEIREDO, 1980). The length at first spawning for *C. chrysurus* has been registered at 95 mm of total length in Northeast region (CUNHA et al., 2000) and 115 mm of total length in Southeast region in Brazilian coastal waters (MAGRO et al., 2000).

C. chrysurus is here reported as a new host to isopod parasite *L. redmanni* captured in the coastal waters of Ponta Negra, Rio Grande do Norte, Brazil.

Samples of the Atlantic bumper, *C. chrysurus* were netted from various locations in the costal waters of Ponta Negra, Rio Grande do Norte, located in the Brazilian Northeast region (Fig. 1). The fishes were captured on a monthly basis, with a help of local fishermen using a beach seine, from January to December 2006. To avoid artifacts of beach seine sampling (in which particularly the isopods abandon their original hosts, possibly live crawling onto another live fish); fishes were examined live, within 30 minute after capture. All fishes captured were weighed to the nearest gram, measured to the nearest millimeter (the body size as the length from tip of snout to the fork of the caudal peduncle) and analyzed the parasitological aspects.

The body surface, buccal cavity and branchial chamber of the each fish were examined for isopod parasites. The parasites were dislodged from their host and preserved directly in a labeled tube with 70% ethyl alcohol. Sex of all parasites were identified, quantified and their sizes measured to the nearest millimeter (length from the tip of head to the end of telson). The sex of the host fishes was determined following Vazzoler (1996).

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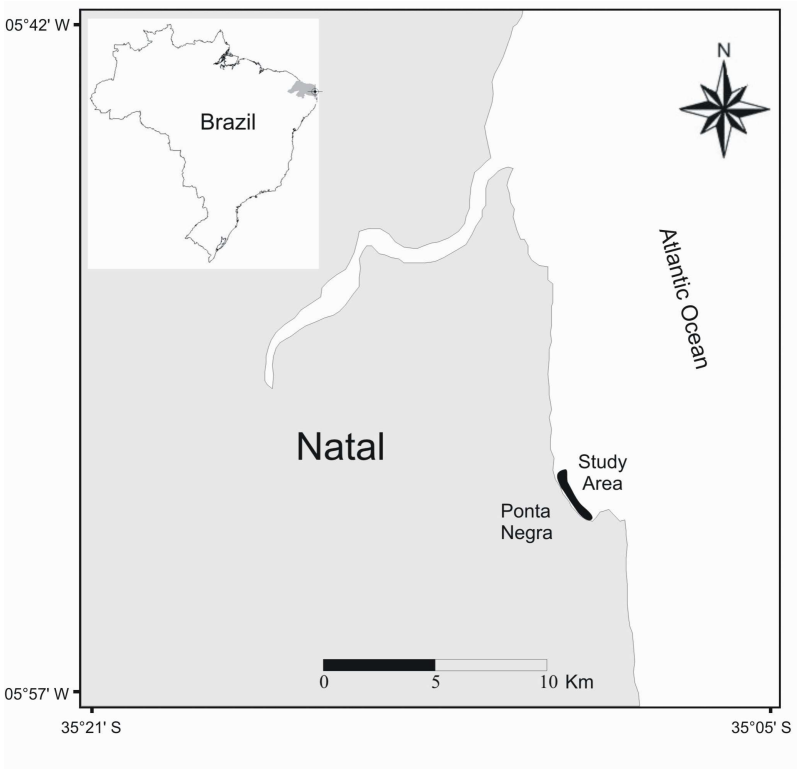

Fig. 1. Location map showing the study area Ponta Negra, Rio Grande do Norte, Brazil.

The parasitological indices were calculated following Bush et al. (1997). The Chi-square (χ^2) test was applied to verify significant differences in the sexual proportion between all male and female fishes collected and the parasitized fishes. The Spearman´s rank correlation test (r_s) was applied to verify the correlation between the fork length of the hosts and the size of the parasites. A significance level of 0.05 was applied in all tests. In the results mean ± standard deviations (SD) are given.

Material analyzed. A total of 204 samples of *C. chrysurus* were captured and which ranged from 32 to 221mm (118 ± 29) in fork length. The length of the 12 parasitized fishes ranged from 93 to 135 mm, and from this total, 12 specimens of the isopod parasite *L. redmanni* were collected (9 females and 3 males).

Parasitological indices and site of fixation. *L. redmanni* showed a prevalence of 5.9%, mean intensity of one parasite per host and a relative abundance of 0.05 parasites per fish captured. The isopods were attached to anterior-ventral portion of the branchial chamber and the heads of the parasites were always directed to the ventral side of the host. Four females of *L. redmanni* were registered carrying eggs and two incidents were registered showing the release of mancae. Damages to the host *C. chrysurus* were caused by *L. redmanni*, and the most obvious effect caused by parasitism was the atrophy and the complete loss of the gill filaments (Fig. 2).

Host-parasite interaction. The sex ratio of the fishes collected was 2 males: 1 female ($\chi^2 = 12.45$, df = 1, $p<0.05$). The male hosts were more parasitized than the females ($\chi^2 = 22.98$, df = 1, $p<0.05$). The sex ratio of *L. redmanni* was 1 male to 3 females. Body size of the male isopods was 12 ± 1.6 in total length and ranged from 10 to 14 mm. Body size of the female isopods was 13 ± 1.7 and ranged from 11 to 15 mm. The relationship between the total length of the parasite (TL_{par}) and fork length of the hosts (FL_{hos}) showed a significant linear regression: $TL_{par} = 5.0693+0.0624*FL_{hos}$ ($r_s = 0.67$, $p<0.05$) (Fig. 3).

The results show that in the coastal waters of Ponta Negra, Rio Grande do Norte, Brazil, around 5.9% of *C. chrysurus* were infected by the isopod *L. redmanni* in the branchial chamber.

The length at first maturation for *C. chrysurus* is at 95 mm of total length in the Northeast region (CUNHA et al., 2000). In this study, the fork length of the parasitized fishes ranged from 93 to 135 mm which were all above the length at first maturation registered for this species.

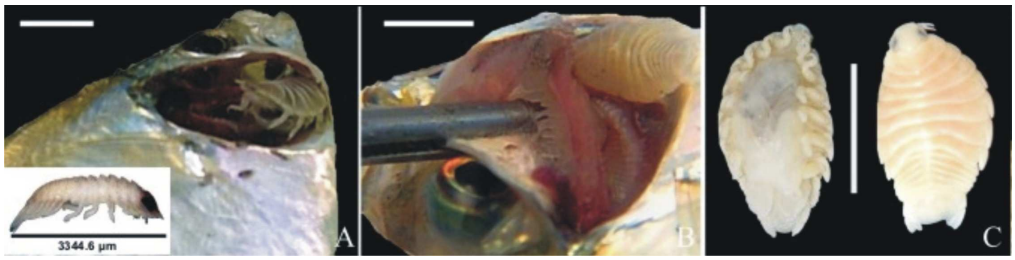

Fig. 2. The marine fish *C. chrysurus* parasitized by *L. redmanni*. *A*) A female specimen of the parasite in the branchial chamber showing the release of mancae of *L. redmanni* (black spots below of the pectoral fin); *B*) Damages on the gill filament caused by parasitism; *C*) A female specimen of *L. redmanni* showing the ventral view marsupium or brood pouch and the dorsal view. Scale bars = 10 mm.

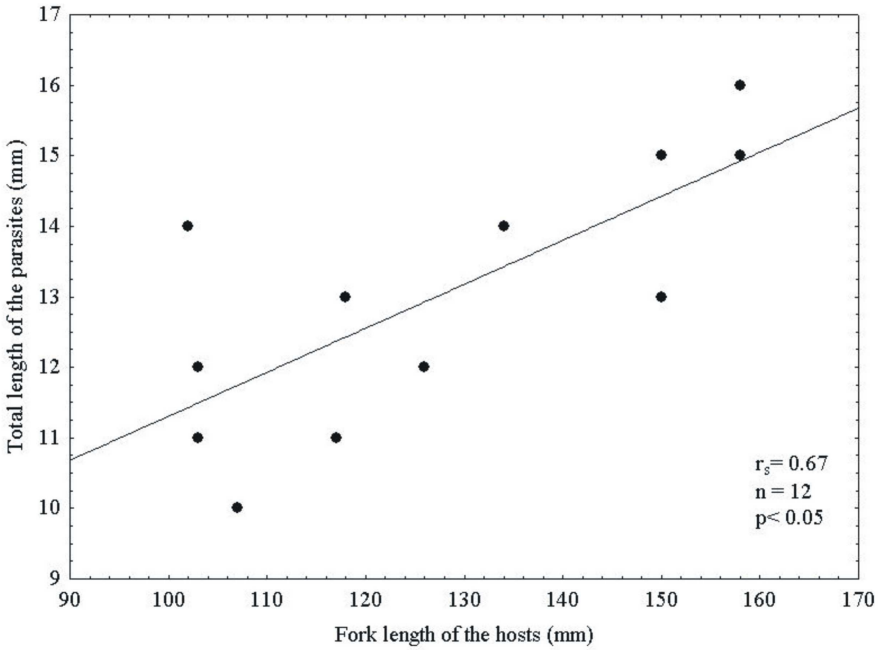

Fig. 3. Linear regression between the body size of the host *C. chrysurus* and the parasite *L. redmanni*.

The incidence and intensity of isopod parasite exhibit considerable variation (RAVICHANDRAN et al., 1999; RAVICHANDRAN et al., 2001; GRUTTER, 2003; CUYAS et al., 2004). BOWMAN (1960) registered the incidence of infection of *Lironeca puhi* on Hawaian Moray eel, *Gymnothorax eurostus* which ranged from 15 to 17%. Sadzikoswski and Wallace (1974) found a prevalence of 1.7% for the isopod *Lironeca ovalis* on white perch, *Morone americana* in the Delaware River. Alas et al. (2008) studying the cymothoid *Nerocila bivittata* on the fish *Parablennius sanguinolentus* (Perciformes, Blenniidae) in the Samsun coast of the Black Sea, found a prevalence of 7.4% and registered *P. sanguinolentus* as a new host to the *N. bivittata.* However, low prevalence of isopod parasite is more frequently registered (SARTOR, 1986).

The female-male pair of *L. redmanni* occurs in each gill cavity of the hosts *S. regalis* and *S. brasiliensis* (Scombridae) thus showing host specificity (WILLIAMS; BUNKLEY-WILLIAMS, 1996). Lima et al. (2005) registered a prevalence of 86% and found up to four specimens of *L. redmanni* in the branchial chamber of the host *S. brasiliensis* in the coastal waters of the Rio Grande do Norte, Brazil. The present study registers one parasite *L. redmanni* per host *C. chrysurus*. Probably, this low prevalence of *L. redmanni* on the host *C. chrysurus* in relation to

Spanish mackerels can be explained based on the body size. Spanish mackerels (*S. regalis* and *S. brasiliensis*) have bigger body sizes which could afford to carry a heavy load of parasites as compared to the smaller size of *C. chrysurus*.

Males predominated the sexual proportion of the fishes colleted in this study. Bello et al. (1997) found that equal numbers of male and female hosts *Atherina boyeri* carry the cymothoid *Mothocya epimerica*. Lima et al. (2005) found a sexual proportion of 1 male:1 female in the population of *S. brasiliensis* in the coastal waters of the Rio Grande do Norte and no relationship between *L. redmanni* and the sex of *S. brasiliensis* was established. Probably the preference of *L. redmanni* for male hosts of *C. chrysurus* is due to the larger proportion of the male hosts and a higher proportion of female parasites.

Isopods inhabiting the branchial chamber inflict damage to gills through attachment and feeding and the extent of damage is directectly proportional to the size of the parasite and duration of settlement (ROMESTAND; TRILLES, 1977; RAVICHANDRAN et al., 2007). A positive and significant correlation was found between the size of both sexes of *L. redmanni* and the body size of the host *C. chrysurus*. Colorni et al. (1997) observed that the size of the females and males of *Livoneca* sp. correlated positively with the body size of the host Red Sea silverside, *Atherinomorus lacunosus* in the Gulf of Eilat. The isopods while in the manca stage usually locate and attaches to the hosts, particularly to young hosts (MENZIES et al., 1955; KROGER; GUTHRIE, 1972; GARREY; MAXWELL, 1982; ADLARD; LESTER, 1995; MARKS et al., 1996; COLORNI et al., 1997; LEONARDOS; TRILLES, 2003). In the definitive host, isopod growth is correlated to the host growth (FOGELMAN; GRUTTER, 2008). Leonardos and Trilles (2003) suggested two strategies in attempt to explain a linear correlation between the host and isopod parasite size. In the first strategy, infections occur early in the life of the fish and then the parasite grows with the host. In the second strategy, the isopod grows rapidly after the infection to a maximum size and then inhibits further growth due to the restricted space of the hosts branchial cavity. The first strategy is more coherent with the results of the present work. Furthermore, the body size affects survival probabilities, reproductive output and individual output of many organisms (TWOMBLY; TISH, 2000). The synchrony of parasite and host growth seems be a natural strategy that increase its own body size and reproductive output (ÁLVAREZ; FLORES, 1997; Leonardos & Trilles, 2003; Chavez-Lopez et al., 2005).

The present study reports for the first time *C. chrysurus* as a host of the isopod parasite *L* in Brazilian coastal waters. Infections by *L. redmanni* on the host *C. chrysurus* occur and the parasite grows with the host and enters in the reproductive phase at a latter stage.

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