First record of parasitism in the mangrove oyster

*Crassostrea rhizophorae* (Bivalvia: Ostreidae)

at Jaguaribe River estuary – Ceará, Brazil

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(With 4 figures)

Abstract

Mangrove oysters *Crassostrea rhizophorae* were sampled monthly in the estuary of Jaguaribe River, on the east coast of Ceará State, Brazil, between August, 2000 and December, 2001, making up 170 individuals. The water temperature varied from 26 to 30 °C and salinity from 21 to 42‰. The animals’ size ranged from 3.4 to 7.2 cm height. Macroscopical and histopathological analyses were carried out in the oysters’ tissues. The histological exams showed protozoans and metazoans of genera *Nematopsis* and *Tylocephalum*, respectively. *Nematopsis* prevalence varied from 60 to 100% and it was higher in the gills and mantle. The oocysts presented a mean size of 11.5 µm (±1.32) length and 9.1 µm (±1.06) width (n = 30), up to 3 oocysts/phagocyte having been observed. Several animals presented focal hemocitical reaction. The percentage of *Tylocephalum* was 1.7%. In spite of the high infection prevalence by *Nematopsis*, infected animals did not have their reproductive cycle impaired.

Keywords: oyster, parasite, histopathology, *Nematopsis*; bivalve.

Resumo

Ostras do gênero *Crassostrea rhizophorae* foram coletadas mensalmente no Estuário do Rio Jaguaribe, litoral Leste do Estado do Ceará, Brasil, entre agosto de 2000 e dezembro de 2001, totalizando 170 animais. A temperatura da água do local variou de 26 a 30 °C e a salinidade de 21 a 42‰. O tamanho dos animais variou de 3,4 a 7,2 cm de altura de concha. As ostras foram submetidas à análise macroscópica e histopatológica dos tecidos. Os exames histológicos evidenciaram protozoários e metazoários dos gêneros *Nematopsis* e *Tylocephalum*, respectivamente. A prevalência de *Nematopsis* variou de 60 a 100% e foi maior nas brânquias e manto. Os oocistos apresentaram tamanho médio de 11,5 µm (±1,32) e 9,1 µm (±1,06), (n = 30), sendo observados até 3 oocistos/fagócito. Alguns animais apresentaram reação hemocítica focal. A porcentagem de *Tylocephalum* foi de 1,7%. Apesar da elevada prevalência de infecção por *Nematopsis*, aparentemente os animais parasitados não tiveram o seu ciclo reprodutivo prejudicado.


1. Introduction

The mangrove oyster, *Crassostrea rhizophorae* (Guilding, 1828), is an important fishery resource in the estuaries of Ceará State, Northeastern Brazil, and its rearing constitutes an alternative of revenue for riverine populations. The diseases can cause significant loss of bivalve mollusks, both in natural and reared areas. According to Figueras and Novoa (2004), studies on bivalve pathologies have been much focalized; however, there are still many questions to answer, i.e. the pathogenicity of new identified parasites and its impact on bivalves.

Protozoans of *Nematopsis* genus (Schneider, 1892) have been reported in many marine bivalves (Azevedo and Cachola, 1992; Carballal et al., 2001; Winstead
et al., 2004; Cremonte et al., 2005). Those parasites are often observed in the gills and mantle of mollusks and complete their life cycle in the gut of marine arthropods (Bower et al., 1994).

Metazoan larvae of Tylocephalum genus Linton (1890) were observed infecting oysters of genera Crassostrea (Cheng, 1975; Winstead et al., 2004) and Pinctada (Hine and Thorne, 2000). Adult individuals of this parasite are found infecting the elasmobranchii’s gut spiral valve (Lauckner, 1983). In South America, there is not enough knowledge about health status and parasites of bivalves (Bower et al., 1994). According to Cremonte et al. (2005), this occurs because the mollusks’ rearing is poorly developed in the coasts of South Western Atlantic. In Brazil, studies on mollusk diseases are recent and scarce. However, they have been enhanced due to the expansion of cultivation systems. Parasitism by Bucephalus sp. was recorded in mussels Perna perna in Santa Catarina State, South Brazil (Silva et al., 2002) and in Anomalocardia brasiliana in Ceará State (Araújo and Rocha-Barreira, 2004). Nematopsis occurrence was recorded in C. rhizophorae (Nascimento et al., 1986), and in mussels Mytella guyanensis (Azevedo and Matos, 1999) and Perna perna (Lima et al., 2001). Metazoans of genus Tylocephalum were observed in C. rhizophorae (Nascimento et al., 1986) and in A. brasiliana (Boehs and Magalhães, 2004).

This study aims to investigate the presence of parasites in the mangrove oyster C. rhizophorae on the Jaguaribe River Estuary, in Fortim, Ceará, Brazil.

2. Material and Methods

2.1. Field procedures

Adult oysters were gathered monthly (n = 10) on the Jaguaribe River Estuary (04° 27’ 07” and 37° 47’ 50”) from August, 2000 to December, 2001, totalling 170 animals. Water variables (temperature and salinity) of the collection site were measured monthly during the whole study period.

2.2. Laboratory procedures

The animals were analyzed in the laboratory of the Bivalve Mollusks Study Group (GEMB), installed in the Marine Science Institute of Federal University of Ceará. The oyster height was measured using a caliper rule according to Galtsoff (1964). After that, a macroscopic exam of the tissues and shells was carried out in order to evaluate the presence or signs of parasitism. For histological procedures, the tissues of each animal were fixed in “Bouin” during 24 hours under room temperature. After fixation, the material was transferred to a 70% ethanol solution and prepared according to the classical histological techniques (Howard and Smith, 1983), which included paraffin embedding, sectioning (5 µm) and hematoxilin-eosin (HE) staining. The slides were examined with an optical microscope, recorded and photomicrographed. All the histological sections of parasited oysters were kept by the authors.

3. Results

The water temperature varied from 26 to 30 °C and salinity from 21‰ (April) to 42‰ (November). Oyster size varied from 3.4 to 7.2 cm shell height. Macroscopical analyses of tissues and shells did not show any symptom or sign of parasitism. However, histopathological analyses detected the occurrence of Nematopsis sp. parasiting mantle, gonads, gills and digestive glands (Figure 1). The prevalence of infection varied from 60% to 100% and it was higher in the gills and mantle (Figure 2). Oocysts measured under light microscopy, presented a mean size of 11.5 µm (±1.32) length and 9.1 µm (±1.06) width (n = 30), with up to 3 oocysts/phagocyte being observed. Several animals presented focal hemocitical reaction (Figure 3). Metazoans larvae of genus Tylocephalum were found capsulated in the connective tissue around the digestive gland, appearing in 1.7% of the analyzed individuals (Figure 4).

4. Discussion

Oocysts occurrence of Nematopsis in the connective tissue of marine bivalves, mainly in the gills, is widely registered (Nascimento et al., 1986; Azevedo and Cachola, 1992; Bower et al., 1994; Azevedo and Matos, 1999; Carballal et al., 2001). Nevertheless, the pathogeny of this gregarine is very doubtful. Azevedo and Cachola (1992), studying the Nematopsis effect on Ruditapes decussatus and Cerastoderma edule, observed destruction of gill cells infected with oocysts and linked it to animal mortality, mainly in C. edule. According to Bower et al. (1994), infections caused by those protozoans are usually associated with a focal hemocyte infiltration, without measurable effects on health. In this study, it was observed that infected animals did not present damage in tissues and/or organs, and apparently they did not have their reproductive cycle impaired.

Only oysters with a high number of oocysts presented histopathological signs of focal host reaction. This effect and small alterations of gill filaments, as a result of lesions, were also observed by Carballal et al. (2001) in C. edule with a high infection degree. Pearls production or calcareous sediment in the internal shell surface was associated with Nematopsis oocysts presence in the mantle tissue of Mytilus edulis (Lauckner, 1983). Lima et al. (2001) and Winstead et al. (2004) verified the absence of pathologic processes linked to Nematopsis presence in the mussel Perna perna and in the oyster C. virginica, respectively. Cremonte et al. (2005) relate also the absence of host response to parasitism by Nematopsis in the gut epithelial cells of Pitar rostrata. Nascimento et al. (1986), observed equally with this study, high prevalence of Nematopsis in oysters C. rhizophorae from Bahia State, Brazil, but it had very low to moderate levels of infection. Those authors concluded that the presence of this protozoan alone is not enough to cause mortality in oysters.

In this work, the slightly lower prevalence of Nematopsis was related to the rainy season, a period
Parasitism in *Crassostrea rhizophorae* from Ceará (Brazil)

Figure 1. Photomicrographs of *Nematopsis* sp. in *Crassostrea rhizophorae*. a) mantle, b) male gonad, c) gills, and d) digestive gland. Staining: HE. Bar = 20 μm.

Figure 2. *Nematopsis* prevalence in *Crassostrea rhizophorae* during the studied period (August, 2000 to December, 2001).

Figure 3. Histological section of the mantle in *Crassostrea rhizophorae* parasitised by *Nematopsis* sp., showing hemocitical reaction (arrow). Staining: HE. Bar = 20 μm.

Figure 4. *Tylocephalum* larva around digestive gland of *Crassostrea rhizophorae*. Staining: HE. Bar = 20 μm.

when both temperature and salinity decrease in the area. However, we cannot establish a relationship between the results and the distribution pattern of the parasite during that period.
The presence of a variable number of Nematopsis oocysts per host cell (phagocyte), usually 1 to 2, with each oocyst containing a single uninucleate sporozoite, coincides with observations made by Azevedo and Matos (1999) and Carballal et al. (2001).

In spite of low presence (1.76%) of the metazoan Tylocephalum found in C. rhizophora during this study, its occurrence seems to be correlated with the higher water temperature, since these organisms are more easily found in tropical and subtropical waters. In relation to its pathogenicity, except for the site where the parasite has lodged, it has been concluded that the larvae do not cause damage to the host. Nascimento et al. (1986), also concluded that damages caused by Tylocephalum in the oyster C. rhizophora from Bahia State had only mechanical effects, caused by the entrance of this cestode into oyster tissues. According to the present study, larvae capsulation of Tylocephalum by fiber cells of the oysters (revealing a response of the host) is recorded in a number of papers (Cheng, 1975; Lauckner, 1983; Hine and Thorne, 2000; Boehs and Magalhães, 2004).

In short, low infection intensity by the parasites found in this work suggests that it is still not interfering in natural stocks or in oyster farming in Ceará State. However, more studies are required in order to evaluate the occurrence and pathogenicity of these and other oyster parasites in the studied region.

References


