

ENDOPARASITES OF THE FISH *PELLONA HARROWERI* (CLUPEIFORMES: PRISTIGASTERIDAE) FROM THE COAST OF PARAÍBA STATE, NORTHEASTERN BRAZIL

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Abstract

Despite the vast literature on fish parasites in Brazil, there are few studies about parasites in Northeast and, even more, on the coast of Paraíba. Among the fishes found on the region, *Pellona harroweri* stands out, found in high abundance and in great distribution throughout the Brazilian coast. The objectives of this study are to identify the parasites present in *P. harroweri* and to correlate the levels of parasitism with its length and relative condition factor. The specimens were collected by nets in October of 2015 in Praia da Penha – Paraíba and then they were identified and necropsied. For data analysis, the prevalence, mean intensity and average abundance values were used to measure parasite infection, the correlation between length and weight with parasite abundance and the relative condition factor (Kn). Among the 36 specimens of *P. harroweri*, 19 were parasitized, with a total of 59 parasites and two species: *Parahemiurus anchoviae* (Digenea: Hemiuridae) and *Contracaecum* sp. (larva) (Nematoda: Anisakidae). The length of the hosts presented no significant correlation with the abundance of *P. anchoviae* ($r_s = -0.220$; $p = 0.203$) or *Contracaecum* sp. ($r_s = -0.156$, $p = 0.368$) and no correlation with host Kn with the abundance of parasites (*P. anchoviae*: $r_s = -0.312$, $p = 0.068$; *Contracaecum* sp.: $r_s = -0.019$, $p = 0.917$) as well. This study shows the first record of a digenetic parasite and nematode *Contracaecum* sp. for *P. harroweri*.

Keywords: Ichthyoparasitology; *Parahemiurus anchoviae*; *Contracaecum* sp.; Relative factor condition.

Resumo

Apesar de haver vasta literatura sobre parasitos de peixes no Brasil, há poucos desses estudos no Nordeste e, menos ainda, na costa da Paraíba. Dentre os peixes encontrados na região, destaca-se a espécie *Pellona harroweri*, encontrada em toda a costa brasileira. Os objetivos dos autores com o presente trabalho foram identificar os parasitos presentes em *P. harroweri* e verificar se os índices parasitários estariam relacionados ao tamanho e grau de hígidez dos hospedeiros. Os peixes foram coletados em outubro de 2015 na Praia da Penha, em João Pessoa, Paraíba, e

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posteriormente identificados e necropsiados. Dentre os 36 espécimes coletados de *P. harroweri*, 19 estavam parasitados, encontrando no total 59 parasitos, pertencentes a duas espécies: *Parahemiurus anchoviae* (Digenea: Hemiuridae) e *Contracaecum* sp. (larva) (Nematoda: Anisakidae). A abundância dos parasitos não apresentou correlação significativa com o comprimento padrão (*P. anchoviae*: $rs = -0,220$ e $p = 0,203$; *Contracaecum* sp.: $rs = -0,156$ e $p = 0,368$), nem com o fator de condição relativo dos hospedeiros (*P. anchoviae*: $rs = -0,312$ e $p = 0,068$; *Contracaecum* sp.: $rs = -0,019$ e $p = 0,917$). Este é o primeiro registro de parasitos dos grupos Digenea e Nematoda parasitando *Pellona harroweri*.

Palavras-chave: Ictioparasitologia; *Parahemiurus anchoviae*; *Contracaecum* sp.; Fator de condição relativo.

Resumen

A pesar de la literatura sobre parásitos de peces en Brasil ser amplia, hay pocos estudios sobre el tema en el Nordeste y, más aún, en la costa de Paraíba. Entre los peces encontrados en la región, se destaca la especie *Pellona harroweri*, encontrada en alta abundancia y en gran distribución por toda la costa brasileña. Los objetivos de este trabajo fueron identificar los parásitos presentes en *P. harroweri* y correlacionar los niveles de parasitismo a la longitud y factor de condición relativo de *P. harroweri*. Se realizó una recolección de arrastre en Octubre de 2015 en Praia da Penha - Paraíba, donde los especímenes fueron recolectados y posteriormente identificados y necropsiados. Sus parásitos fueron recolectados y fijados a etanol 70% para posterior identificación. Para el análisis de los datos, se utilizaron los valores de prevalencia, intensidad media y abundancia media para medir la infección por el parásito, además de la correlación entre la longitud y el peso con la abundancia de parásitos y el factor de condición relativo (Kn). Entre los 36 especímenes recogidos de *P. harroweri*, 19 peces estaban parasitados, encontrando un total de 59 parasitos, con dos especies distintas: *Parahemiurus anchoviae* (Digenea: Hemiuridae) y *Contracaecum* sp. (larva) (Nematoda: Anisakidae). La longitud no tuvo correlación con la abundancia de *P. anchoviae* ($rs = -0,220$, $p = 0,203$) o *Contracaecum* sp. ($rs = -0,156$, $p = 0,368$), así como tampoco tuvo correlación con el Kn de los huéspedes con la abundancia de parásitos (*P. anchoviae*: $rs = -0,312$ y $p = 0,068$; *Contracaecum* sp.: $rs = -0,019$ y $p = 0,917$). El trabajo muestra el primer registro de un parásito digenético y del nematodo *Contracaecum* sp. para *Pellona harroweri*.

Palabras-clave: Ictioparasitología; *Parahemiurus anchoviae*; *Contracaecum* sp.; Factor de condición relativo.

INTRODUCTION

Parasitism is a very common disharmonious interaction in species of fish (Luque et al. 2011). Parasites are a very important component of biodiversity and, despite the vast literature on fish parasites in Brazil (Pavanelli et al. 2013), there are

few studies about parasites of marine fishes in northeastern Brazil and, even less, on the coast of Paraíba State. According to Jorge and Poulin (2018), this region belongs to areas where disproportionately few parasites have been discovered relative to local host richness.

The fish *Pellona harroweri* (Fowler, 1917) (Clupeiformes: Pristigasteridae), popularly known as “sardinha-manteiga”, is a commonly captured species in the coast of the city of João Pessoa. It is a small pelagic fish which occurs in shallow coastal waters in estuaries of tropical and subtropical regions (Muto et al. 2008), distributed along the Western Atlantic, from Panama, to southern Brazil (Froesy and Pauly, 2019). It feeds mostly on crustaceans, including copepods and luciferid shrimps (Criales-Hernández 2003). *Pellona harroweri* has no significant economic value, being more captured by trawling to serve as bait or subsistence fishing, and it represents an important food resource for organisms that occupy the next trophic level (Muto et al. 2008). Along its distribution range, it has been reported as a food item for mammals (Bordignon 2006), birds (Serrano and Azevedo-Junior 2005) and other species of fish such as *Trichiurus lepturus* (Duarte et al. 1999). Although its wide distribution range, there is only one parasitological record for *P. harroweri*, which is an unidentified cymothoid near the city of Santos, São Paulo State, Brazil (Sartor 1986).

According to Cordeiro (2007), a positive correlation of the length of the host to its parasite's abundance indicates the tendency to favor the concentration of parasites, referring to the cumulative process of parasitic infestation, where larger fish may have more endoparasites because of the ingestion of intermediate hosts. The relative condition factor (Kn) (Le Cren 1951) is a measure or a quantitative indicator of fish welfare (Vazzoler 1996). This parameter has been widely used in the last decades and can be an important tool for the study of parasite-host interactions (Lizama et al. 2006). In normal conditions, the theoretically expected value is $Kn = 1$ and any event that interferes with fish health or well being, such as parasitism, can produce variations in this value (Lucas et al. 2011).

This study aims to identify the endoparasites of the fish *P. harroweri* from the coast of the Paraíba State, as well as to investigate possible correlations between parasitism indices and the length and the relative condition factor of the hosts.

MATERIAL AND METHODS

The fish were caught using nets at the Penha Beach (7°09'51.84"S 34°47'44.92"O), city of João Pessoa, State of Paraíba, in October 2015. In the laboratory, the fishes were identified, numbered, weighed, measured and necropsied. Organs were observed under stereomicroscope, and parasites were conserved in 70% ethanol. For identification, the specimens were clarified in Hoyer's medium (Digenea) and Lactophenol of Amman (Nematoda), and stained with acetic carmine (Digenea) (Eiras

et al. 2006). Permanent slides were mounted in Canada balsam. The identification of parasites was according to Thatcher (2006), Moravec (1998), Bray (1990). The prevalence (percentage of infected hosts in the sample), mean intensity (total number of parasites divided by the number of infected hosts), mean abundance (total number of parasites divided by the number of hosts analyzed) and the ecological terminology were used according to Bush et al. (1997). The data analysis used the correlation coefficient by Spearman “rs” to verify possible correlations between the standard length of the hosts and its condition factor and the abundance of parasites, considering $\alpha=0.05$.

RESULTS AND DISCUSSION

In total, 36 specimens of *Pellona harroweri* were collected. Nineteen hosts were parasitized by at least one parasite species. Fifty-nine parasites were collected, being identified as *Parahemiurus anchoviae* Pereira & Vaz 1930 (30 specimens) and larvae of *Contracaecum* sp. (29 specimens). Parasitological indexes are in Tab. 1.

Table 1. Endoparasites of 36 specimens of *Pellona harroweri* collected from the coast of João Pessoa, Paraíba State, and their parasitological indexes (P = prevalence, MI = mean intensity, MA = mean abundance, Min-Max = mínimo e máximo por hospedeiro, SD = standard deviation).

Parasite	P (%)	MI \pm SD	MA \pm SD	Min-Max
<i>Parahemiurus anchoviae</i>	25.7	3.33 \pm 2.87	0.86 \pm 2.03	1-8
<i>Contracaecum</i> sp.	45.7	1.81 \pm 1.17	0.82 \pm 1.20	1-3

The parasites from subclass Digenea, family Hemiuridae, were identified as *Parahemiurus anchoviae* based on a comparative study of Bray (1990) (Tab. 2). The parasite found has a subglobular oral sucker, pre-pharynx absent and subglobular pharynx. It presents a short esophagus, direction of ceca going from the anterior region to the ecsome, which is well developed and has a terminal pore. Nearly symmetrical testicles and oval or rounded seminal vesicle, located in the anterior half of the body. A post-testicular, oval or subglobular ovary. Uterus posterior to vitellaria, occasionally reaching the ecsome. Small and numerous eggs and two ovarian or irregular post-ovarian masses, representing the vitellaria. Distinct caeca only in the posterior region, reaching the ecsome.

Table 2. Size of body structures in micrometers (μm) comparing *Parahemiurus anchoviae* found in present study with *Parahemiurus anchoviae* (Bray 1990).

Structure	<i>P. anchoviae</i> (present study)	<i>P. anchoviae</i> (Overstreet 1969)
Body length and width	1510x230	505x158
Oral sucker	50x60	31x32
Pharynx	30x30	23x29
Acetabulum	12x160	70x75
Seminal vesicle	150x60	62x38
Testicle 1	110x70	54x35
Testicle 2	120x60	60x34
Ovary	70x80	38x48
Vitellaria	60x50	38-41x38-38
Eggs	20x10	21-13x9x12

The parasite *Parahemiurus anchoviae* was identified for having many similarities with the collected digenean parasites. Individuals from the family Hemiuridae have as main characteristic the ability to retract the final part of the posterior region of the body, known as ecsome (Coutinho 2016). Although the measures of *P. anchoviae* found to be almost twice the size of *Parahemiurus anchoviae* in Overstreet (1969) study, they present the same proportion of suckers ($1 > 2.1$). Also, the uterus going from the posterior region to the vitellaria, reaching the ecsome and going towards the anterior part, reaching the acetabulum and by the equal size of eggs. Still according to Bray (1990), the record of *P. anchoviae* in his article was recorded in Brazil.

Bray (1990) indicates that although individuals of the genus *Parahemiurus* show folds throughout their body, these folds are only considered good parameters for the identification of the individual when it is well fixed, since a material that was not properly fixed, that mainly belongs to hosts that have been frozen, the folds are not a good feature for the identification in question and may have been lost or distorted. Other parameters such as size ratio of the suckers and the size of the eggs might best help indicate the species.

Bray (1990) cites that *P. anchoviae* was found parasitizing the hosts *Pomatomus saltator* in Santa Catarina and *Anchoa lyolepis* in Florida, United States (Overstreet 1969). Also, *P. anchoviae* was recorded in *Lycengraulis grossidens* and *Mugil planatus* in Rio de Janeiro, Santos and São Paulo (Kohn and Fernandes 2016). The present work indicates that this is the first record of *P. anchoviae* for *Pellona harroweri* and for the Northeast region of Brazil.

The nematode *Contraecum* sp. larva belongs to family Anisakidae and has a long body of 4950 μm with maximum width 200 μm . The larva has a round head with a small ventral tooth followed by excretory pore and poorly developed lips. Muscular esophagus with 625 μm followed by a glandular esophagus of 275 μm . Nervous

ring not observed. Glandular esophagus overlapping the intestine, which extends towards the muscular esophagus. It has a conical and striated end. The nematode *Contracaecum* sp. (larva) was identified according to Moravec (1988) because it has a small ventral tooth next to lips and the intestine extending towards the muscular esophagus in anterior region.

According to Madi and Silva (2005) and Santos et al. (2016) the genus *Contracaecum* sp. was recorded in Argentina, Venezuela, Chile, Mexico, Uruguay, Peru and Colombia. This genus has more than 40 records in Brazil, including *Aluterus monoceros*, *Centropomus undecimalis*, *Diapterus rhombeus*, *Epinephelus masarginatus*, *Heptranchias perlo*, *Lophius gastrophysus*, *Menthicirrhus americanos*, *Mustelus canis*, *Oligoplites saurus*, *Paralonchurus brasiliensis*, *Scomberomorus brasiliensis*, *Trichiurus lepturus* e *Urophycis brasiliensis*, besides *Cichla ocellaris* and *Hoplias malabaricus* in Paraná, and *Scomberomorus cavalla* and *S. maculatus* in Ceará (Martins et al. 2003; Santos et al. 2016; Klein 1973).

The length of the hosts varied between 5.0 and 8.6 cm (6.9 ± 0.8) and their weight between 2.9 and 13.6 g (7.7 ± 2.4). The correlation between host length and parasite abundance was calculated for each parasite species. There was no correlation between host length and abundance of *P. anchoviae* ($r_s = -0.220$, $p = 0.203$) or *Contracaecum* sp. ($r_s = -0.156$, $p = 0.368$), indicating that as the amount of parasites was relatively low, and the abundance of parasites found did not relate to the length of the hosts. This was also observed in studies by Paraguassú and Luque (2007) and by Azevedo et al. (2007) that, since host body length can be an indicator of their age, suggest that food items in different age groups should be similar and that there should be no variation in habitat use in this species, relative to endoparasites.

The condition factor is a measure or quantitative indicator of fish welfare (Vazzoler 1996). In normal conditions, the expected value is $K_n = 1$ and any event that interferes with fish health, such as parasitism can produce variations in this value (Lucas et al. 2011). The K_n of the hosts varied between 0.92 and 1.10 and there was no significant correlation between the K_n and the abundance of the parasites *P. anchoviae* ($r_s = -0.312$, $p = 0.068$) or *Contracaecum* sp. ($r_s = -0.019$, $p = 0.917$), indicating that the amount of parasite did not correlate with the condition of the hosts. Studies by Lemos et al. (2007) and Santos et al. (2013) presented similar results, where K_n was not significantly correlated with the abundance of parasites. Relative condition factor's variations can occur due to diverse environmental conditions and behavioral aspects of the species and by factor such as age, sex or fish maturity (Vazzoler 1996; Le Cren 1951).

CONCLUSIONS

This is the first record of endoparasites in *P. harroweri*, as well as the first record of *P. anchoviae* in northeastern Brazil. The abundances of the recorded

parasites, *Parahemiurus anchoviae* and *Contracaecum* sp., were not correlated with the host's length or relative condition factor.

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