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First record of the biodiversity of isopods in *Katsuwonus pelamis* from South America (NE Brazil)

Abstract

The dispersion pattern of the parasites has been considered of great importance to the population dynamics of the parasite-host relationship. Studies on ectoparasites of marine fish in the Brazilian Northeast are considered a relatively new field of knowledge, with few studies. This study aimed to evaluate the biodiversity and report the first occurrence of three parasitic isopods in host-fish Skipjack tuna (*K. pelamis*) from the Southwest Atlantic Ocean-Rio Grande do Norte, Brazil. Fish-hosts were acquired from fishermen in the coastal area of Areia Branca (state of Rio Grande do Norte–NE Brazil) between the years December/2015 to November/2016, realizing biometrics and parasitic collecting. The parasites collected were permanently mounted for identification, which was performed with the help of a stereomicroscope using taxonomic identification keys proposed for specimens of parasites of the isopods. The parasitic ecological indices (prevalence, mean intensity and mean abundance) were calculated. The results show the identification of three isopods species with their respective prevalence: *Rocinela signata* (11.76%), *Lironeca redmanni* (8.82%) and *Cymothoa sp*. (7.84%) were considered low compared to other hosts of these species. The microhabitat of the largest occurrence of parasitism of the species was branchial chambers followed by body skin and buccal cavity of the hosts.

Keywords: isopods in scombridae, parasitized fish, marine fish, skipjack tuna

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Introduction

The dispersion pattern of the parasites has been considered of great importance to the population dynamics of the parasite-host relationship.[1,2] Are the parasitic abundance dependent processes influence on survival and fertility of hosts.[3] Studies on ectoparasites of marine fish in the Brazilian Northeast is considered a relatively new field of knowledge, with few studies.[4] According to Carvalho et al.,[5] variations in the composition of a parasite community can be determined by changes in environmental conditions and habitat of hosts that may be subject to possible influence of seasonal cycles. Crustaceans are an extensive group with many subdivisions. A large number of crustaceans which are parasites of fish (freshwater and marine water), being all ectoparasites, even if its location is not visible externally, in this case are buried in small pockets located immediately beneath the tegument, but being in contact with the outside by a small pore.[6] The huge morphological and ecological diversity of Crustacea there is no correspondence in any other animal taxon. The main groups comprising fish parasites are copepods, Branchiura and Isopoda.[6,7] The Crustaceans isopods (Isopoda Order) do part of the main group of fish parasites.[6] Isopods measure between 0.5 to 500.0mm in length and the phylogenetic analysis of the fossils of this group suggests that they existed since the Carboniferous period of the Paleozoic era, with approximately 300million years.[8] In South America, some 8genera were recorded with 17species of isopods parasites of fish in marine ecosystems and 10genera with 25species of isopods parasites of fish freshwater.[9] Studies on isopod parasites of marine fish are scarce in Brazil, considering the great diversity of fish in coastal waters. Skipjack tuna *Katsuwonus pelamis* (Scombridae family) is an opportunistic predator that inhabits the tropical and warm temperate waters of all oceans. The range of this fish in Atlantic Ocean is from 40°C to 32°S, from the surface to about 260m depth. The range of this fish in the Atlantic Ocean is from 40°N to 32°S, from the surface to about 260m depth. Its distribution is influenced by water temperature (optimum range from 15 to 30°C). The skipjack tuna spawns when the surface temperature is ≥24°C, and its spawning season varies according to locality.[10] This study aimed to evaluate the biodiversity and report the first occurrence of three parasitic isopods in host-fish Skipjack tuna (*K. pelamis*) from the Southwest Atlantic Ocean-Rio Grande do Norte, Brazil.

Material and methods

Located in the northeast of Brazil, the coastal region of Rio Grande do Norte (Figure 1) has humid tropical climate hot, with rains in the Summer (December to March) and dry conditions in Spring, Winter and Autumn (April to November), with an annual mean of 823mm of rain and 32°C air temperature.[11] Skipjack tuna specimens (*Katsuwonus pelamis*) they were collected during the years 2015-2016 in the fishing area of Areia Branca. All fish were submitted biometrics, weighed in grams (g); the length was measured in millimeters (mm) and sexed according to Vazzoler.[12] After capturing in the study area and the realization of biometrics, the fish were necropsied for conducting the parasitic investigation. The harvest of parasitic fauna was carried out according to each specimen found by following the recommendations of Eiras et al.,[6] and the identification followed the guidelines of Thatcher and Brites-Neto[13] to isopods. The integument regions of the body, nasal cavities, mouth and gills were analyzed. The collected specimens were stored in alcohol 70%. To verify a possible influence of sex and length of the parasitic hosts, abundance was carried out analysis Student's t-test at 5% significance ($p<0.05$). After initial procedures, isopods fixed in alcohol 70% were counted, and the parasite species were identified with proposed taxonomic identification keys for the study group. The parasitic ecological indexes were calculated and expressed as Bush et al.,[14] and Silva et al.[11] *Prevalence (P%)*: was determined using the equation of the ratio between the number of hosts infected with one or more individuals of a taxonomic group and the number of hosts examined; *Mean Intensity (mI)*: it was determined using the equation of the relationship between the total number of parasites a taxonomic group and number of host

species infected with those parasites; *Mean Abundance (mA)*: it was determined using the equation of the relationship between the total number of parasites a taxonomic group, and the total number of hosts examined (infected and uninfected).

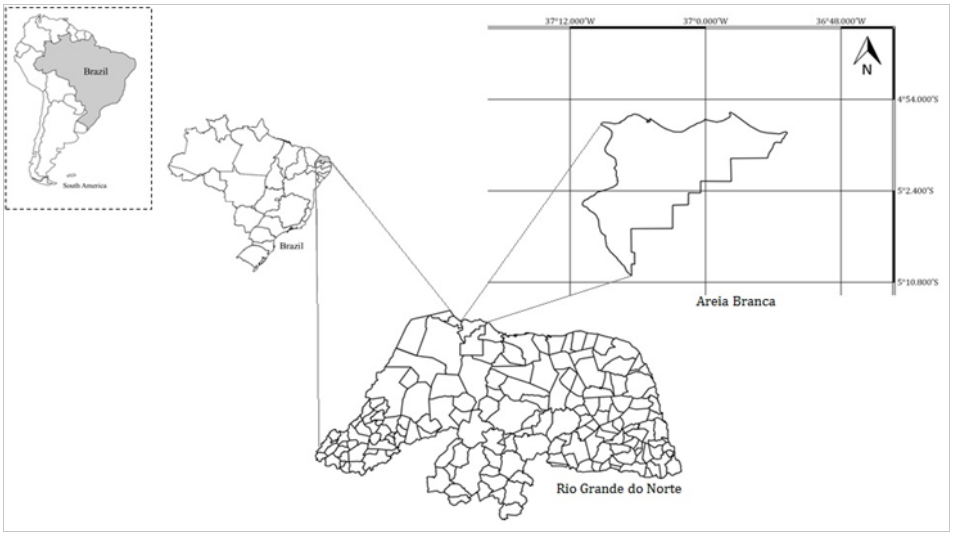

Figure 1 Map of south America (highlighting Brazil) and the state of Rio Grande do Norte highlighting the region of acquisition of the animals (Areia Branca).

Results

They were acquired hundred and two (n102) host-fish Skipjack tuna (*Katsuwonus pelamis*) between the sampling months (December/2015 to November/2016), presented values biometric these according to Table 1. It was observed that there was a predominance of males between the collected fish (54males and 48were females) months in the study. Isopod parasites were identified from their morphological characteristics with taxonomic identification keys: *Cymothoa* sp. parasitizing the microhabitats in the oral cavity of the host; *Lironeca redmanni* parasitizing the branchial chambers and the oral cavity of the hosts; and *Rocinela signata* parasitizing the branchial chambers and body skin of the hosts. The parasitic ecological index of *Cymothoa* sp., *Lironeca redmanni* and *Rocinela signata* infesting the skipjack are shown in Table 2. No significant differences were observed regarding the ecological index the identified species and length and weight in this study (P>0.05).

Table 1 Values of biometrics of the population of males and females of *Katsuwonus pelamis* (LF, length fork; WT, total weight; Min, minimum; Max, maximum; Mean; SD, Standard deviation).

Values	WT (g)		LF (mm)	
	♀	♂	♀	♂
min	940.8	1767	423	450
max	5330	10100	700	800
mean ± SD	2819.9+1019.9	36,25,8+1767.7	530+66	581+81

Table 2 Ecological Indices of parasites isopods in *Katsuwonus pelamis*. Number of parasites (N), prevalence (P%), mean intensity (ml), mean abundance (mA) and location of infestation.

Parasites	N	P%	ml	mA	Location of infestation
Cymothoa sp.	8	7.84	1.6	0.08	buccal cavity
Lironeca redmanni	14	8.82	1.56	0.14	branchial chambers
Rocinela signata	21	11.76	1.75	0.21	branchial chambers and body skin

Discussion

According to Carvalho and Luque[5] studies in naturally infected hosts are important for the understanding of population indicators and registration of new hosts and new geographical areas of parasitic species. This study reports for the first time the biodiversity and occurrence of isopods *Cymothoa* sp., *Lironeca redmanni* and *Rocinela signata* parasitizing Skipjack tuna (*Katsuwonus pelamis*) from the Southwest Atlantic Ocean. According to Schalch,[15] in habitat in which there is constancy in temperature of the water as water in the Northeast, the seasonal variations of parasitism are not significant. Isopods found themselves in the branchial chambers, oral cavity and body skin, habitat of typical parasitism for these parasites according to other researchers. The parasitic shapes could be observed to the naked eye because of the size these specimens had and consisted of adults. In marine fish of commercial value coastal in waters of Rio Grande do Norte Cavalcanti et al.,[16] and Lima,[17] recorded the occurrence of ectoparasites isopods (Cymothoidae) and copepods in marine fish Serra Spanish mackerel (*Scomberomorus brasiliensis*) and Palombeta (*Chloroscombrus chrysurus*). Cavalcanti et al.,[18] recorded the occurrence of ectoparasitos in the Coro (*Pomadasys corvinaeformis*) and the Tainha (*Mugil curema*), followed by the Palombeta (*C. chrysurus*), Serra Spanish mackerel (*S. brasiliensis*) and Tibiro (*Oligoplites saurus*). So this study reports for the first time

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the occurrence of isopod parasite in Skipjack tuna (*K. pelamis*) caught in state waters of the Rio Grande do Norte, northeastern Brazil. Of the species found in this study (*R. signata, L. redmanni* and *Cymothoa* sp.) none of these had previously been cited for this host even in the works already carried out with this fish in Rio de Janeiro (Brazil) by Alves et al.,[19] and in the Mediterranean Sea by Mele et al.[10] Prevalences of *R. signata* (P%=11.76%), *L. redmanni* (P%=8.82%) and *Cymothoa* sp. (P=7.84%) in Skipjack tuna are below the values found by Lima[17] with the fish *Scomberomorus brasiliensis* in the same region in study (Rio Grande do Norte), the prevalence of these parasites It was 44.4% in *R. signata*, 21.2% in *L. redmanni* and 72% in *C. spinipalpa*. Bullard et al.,[20] mentioned that the behaviour of forming shoals facilitates the horizontal dispersion of the larvae in some species of fish, however, the ecological parameters of the three species of isopods indicate that this behavioral fact, in the present study with Skipjack tuna (*K. pelamis*), did not influence the horizontal transmission of the parasite species under study it can only be a case of accidental parasitism or an adaptation in a new species of host. Various studies have been conducted over the years to determine the diversity and relative effect of parasitism in the world.[21] However, there is little information on the parasites in Skipjack tuna and other species off the coast of Rio Grande do Norte.

Conclusion

This work made the taxonomic identification of parasitic isopods and recorded for the first time occurrence of *Rocinela signata*, *Lironeca redmanni* and *Cymothoa* sp. in Skipjack tuna caught in the Rio Grande do Norte coast, so characterized a new host for these three species of parasites. The prevalence of parasitic *R. signata* (11.76%), *L redmanni* (8.82%) and *Cymothoa* sp. (7.84%) were considered low compared to other hosts of these species. The microhabitat of the largest occurrence of parasitism of the species was branchial chambers followed by body skin and buccal cavity of the hosts.

Ethical approval

All procedures performed this study involving animals were in accordance with the ethical standards of the institution.

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Conflicts of interest

The author declares that there are no conflicts of interest.

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