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NOTA CIENTÍFICA

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First record in South America of *Didymocylindrus filiformis* (Digenea, Didymozoidae) infecting the gills of Skipjack tuna *Katsuwonus pelamis*

Primeiro registro na América do Sul de *Didymocylindrus filiformis* (Digenea, Didymozoidae) infectando as brânquias de Bonito listrado *Katsuwonus pelamis*

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Abstract Parasites are excellent biological indicators to investigate the ecology, migration and population structure of marine organisms, and the geographical distribution of Didymozoidae family is unfamiliar and the identification taxonomic of specimens of parasites in this family is very difficult to be determined due to their morphology being unfavorable for the activity of parasite identification. This study reports, for the first time in South America, *Didymocylindrus filiformis* on skipjack tuna (*Katsuwonus pelamis*) in Brazil. The results showed a prevalence of 22.5% of the parasite *D. filiformis* in the branchial chamber of its host (skipjack tuna-*K. pelamis*) on new geographic area.

Palavras-chave: Parasite, Didymozoidae, South America, Fish host, New geographic area

Resumo Os parasitos são excelentes indicadores biológicos para investigar a ecologia, migração e estrutura populacional de organismos marinhos, e a distribuição geográfica da família Didymozoidae não é familiar e a taxonomia de identificação de espécimes de parasitas desta família é muito difícil de ser determinada devido à sua morfologia ser desfavorável para a atividade de identificação de parasitária. Este estudo relata, pela primeira vez na América do Sul, *Didymocylindrus filiformis* no bonito listrado (*Katsuwonus pelamis*) em águas do Brasil. Os resultados mostraram uma prevalência de 22,5% do parasita *D. filiformis* na câmara branquial do seu hospedeiro (bonito listrado-*K. pelamis*) na nova área geográfica de ocorrência.

Palavras-Chave: Parasito, Didymozoidae, América do Sul, Peixe hospedeiro, Nova área geográfica

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Introduction

Parasites are excellent biological indicators to investigate the ecology, migration and population structure of marine organisms, and are also successfully used to clarify the relationships taxonomic between hosts (MacKenzie & Abaunza, 2014; Mele et al., 2014), this due to its ecological ubiquity and the restricted dependence on its hosts (Whiteman & Parker, 2005).

The trematods of the Didymozoidae family are parasites of marine fish, having as definitive hosts mainly to families Scombridae, Exocoetidae, Serranidae and Sphyraenidae, found predominantly in tropical and subtropical waters (Justo et al., 2008). Fish and squid have been reported as intermediate hosts of juvenile Didymozoids (Pozdnyakov & Gibson, 2008). The geographical distribution of these parasites in marine environments is unfamiliar and the identification taxonomic of specimens of parasites in this family is very difficult to be determined due to their morphology being unfavorable for the activity of parasite identification (Mele et al., 2016; Melo et al., 2013; Pozdnyakov & Gibson, 2008).

The genus *Didymocylindrus* has worldly described eleven (11) species, these are: *Didymocylindrus apharyngi*; *D. cylindricus*; *D. filiformis*; *D. fusiformis*; *D. gasteralis*; *D. opercularis*; *D. pharyngi*; *D. simplex*; *D. singularis*; *D. sphyraenae* and *D. trilobatus*.

The skipjack tuna *Katsuwonus pelamis* Linnaeus, 1758 (Osteichthyes: Scombridae) is an opportunistic predator that inhabits the warm and tropical temperate waters of all the oceans (Mele et al., 2012). This study aimed, the contribution to the increase in knowledge and expansion of the geographical distribution of the parasite *Didymocylindrus filiformis*, reporting for the first time in South America the record of this species parasite *Katsuwonus pelamis* in the waters of the Southwest Atlantic Ocean.

Material and Methods

Between December/2015 and November/2016, they were acquired in the fishing region of Rio Grande do Norte, northeast of Brazil (Southwest Atlantic Ocean) (Fig. 1) specimens of Skipjack tuna (*Katsuwonus pelamis*). All fish collected were subjected to analyses meristic and morphometric measurements, mainly registering the length (in millimeters), weight (in grams) and sexed (males and females).

Figure 1. Map of South America highlighting Brazil, showing the Rio Grande do Norte region and the sampling site.

The identification of fish has been confirmed using the identification key of the species of Scombridae family. In the laboratory were conducted necropsies in the hosts the search for parasites following the standard techniques. The gills of all specimens were excised and processed. The parasites found were labelled (the host number, attachment area, place and date of collection), photographed and packed in glass tubes with 70% ethanol. The parasites were identified with appropriate taxonomic references to the species, which included Ishii (1935) and Pozdnyakov & Gibson (2008).

The digenetics of the Didymozoidae family were prepared as permanent brackets following standard protocols and were deposited in the UFERSA's Aquatic Sanity Laboratory collection. The ecological indexes parasitological, such as prevalence (percentage of infected hosts), mean intensity (average number of parasites per infected host) and mean abundance (average number of parasites per host), were calculated according to Kvach et al. (2017) and Ruiz-Torres et al. (2017).

Results and Discussion

The specimens of skipjack tuna (n 102) acquired between the months of collecting, have presented minimum length values of 423.0 mm and maximum of 800.0 mm (mean 553.3 and ±standard deviations 69.2); minimum weight of 940.8 g and a maximum of 10100.0 g (M 3287.3 and ± SD 1545.4), and a total of 54 males and 48 females.

The species was identified according to Ishii (1935) and Pozdnyakov & Gibson (2008), being *Didymocylindrus filiformis*. The ecological indexes of this parasite in skipjack tuna parasitological were prevalence (22.5%), mean intensity (1.3) and mean abundance (0.28).

No significant differences were encountered ($P > 0.05$) of prevalence and mean intensity between the sexes and sizes of hosts, there was no significant correlation between the intensity of the infection and the size or sexes of the host.

Didymocylindrus filiformis has not yet been registered in South America, although this species is common parasitizing *K. pelamis*, porting this is the first record of this parasite infesting natural host skipjack tuna in a new geographic area. Most of the skipjack tuna parasites presents a wide geographic area, being found from Ecuador to the temperate latitudes of the Atlantic and Pacific oceans, and infects more than one host species (Mele et al., 2012).

In South America, mainly in Southwest Atlantic Ocean, there are a small number of species reported, in contrast to well-studied regions of the Pacific Ocean (Felizardo et al., 2011). The fauna parasites Didymozoidae of the gills of skipjack tuna (*K. pelamis*) had already been described by Alves & Luque (2006), Justo & Kohn (2005) and Justo et al. (2013; 2012; 2008) in the Atlantic Ocean and Mele et al. (2012) in the Mediterranean Sea.

The species described in this study (*Didymocylindrus filiformis*) for the first time in South America, was originally described in the Pacific Ocean by Ishii (1935) parasitizing *Katsuwonus pelamis* and *Thunnus orientalis*, Lester et al. (1985) reported this species in the Caribbean in *K. pelamis* and Mladineo, Žilić, & Čanković (2008) in Mediterranean parasitizing *Thunnus thynnus*. The studies that have already reported the occurrence of this parasite, an ecological relationship is observed between *D. filiformis* and the species of host-fish *K. pelamis* and *T. thynnus*, but due to the high values of prevalence in *K. pelamis*, this parasite is characterized as specific for this species although it may occasionally infect other tunas (Ishii, 1935; Lester et al., 1985; Mele et al., 2012; Mladineo, Žilić, & Čanković, 2008).

This study contributes to increasing the knowledge and the new geographical distribution of *D. filiformis*. Until this present study, no species *D. filiformis* had been notified in Brazil or South America, thus this study recorded the occurrence of the metazoan digenetic hosting skipjack tuna (*K. pelamis*) captured in waters of the coast of Rio Grande do Norte, northeast of Brazil (Southwest Atlantic Ocean).

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References

Alves, D. R., & Luque, J. L. (2006). Ecologia das Comunidades de Metazoários Parasitos de Cinco Espécies de Escombrídeos (Perciformes: Scombridae) do Litoral do Estado do Rio de Janeiro, Brasil. *Rev. Bras. Parasitol. Vet.*, *15*, 167–181.

Felizardo, N. N., Justo, M. C., Knoff, M., Fonseca, M. C. G., Pinto, R. M., & Gomes, D. C. (2011). Juvenile didymozoids of the types, *Torticaecum* and *Neotorticaecum* (Didymozoidae: Digenea), from new marine fish hosts (Pisces: Teleostei) in the neotropical region of Brazil. *Journal of Helminthology*, *85*(3), 270–275. doi: 10.1017/S0022149X10000507

Ishii, N. (1935). Studies on the family Didimozoidae (Monticelli, 1888). *Jap. J. Zool.*, *6*, 279–335.

Justo, M. C. ., & Kohn, A. (2005). Didymozoidae (Digenea) parasites of Scombridae (Actinopterygii) from Rio de Janeiro coast, Brazil. *Rev. Bras. Zoociências*, *7*(2), 333–338.

Justo, M. C. N., & Kohn, A. (2012). A new genus and species of the Didymozoidae (Digenea) from the skipjack tuna *Katsuwonus pelamis* (L.)(Scombridae). *Systematic Parasitology*, *81*(3), 195–201.

Justo, M. C. N., Kohn, A., Pereira, C. de S., & Flores-lopes, F. (2013). Histopathology and autoecology of *Didymocylindrus simplex* (Digenea: Didymozoidae), parasite of *Katsuwonus pelamis* (Scombridae) in the Southwestern Atlantic Ocean , off South America. *Zoologia*, *30*(3), 312–316. doi: 10.1590/S1984-46702013000300008

Justo, M. C. N., Tortelly, R., Menezes, R. C., & Kohn, A. (2008). First record in South America of *Didymosulcus palati* and *Didymosulcus philobranchiarca* (Digenea, Didymozoidae) with new hosts records and pathological alterations. *Memorias do Instituto Oswaldo Cruz*, *103*(2), 207–210. doi: 10.1590/S0074-02762008000200014

Kvach, Y., Jurajda, P., Bryjová, A., Trichkova, T., Ribeiro, F., Přikrylová, I., & Ondračková, M. (2017). European distribution for metacercariae of the North American digenean *Posthodiplostomum* cf. *minimum centrarchi* (Strigeiformes: Diplostomidae). *Parasitology International*, *66*(5), 635–642. doi: 10.1016/j.parint.2017.06.003

Lester, R. J. G., Barnes, A., & Habib, G. (1985). Parasites of skipjack tuna, *Katsuwonus pelamis*: fishery implications. *Fishery bulletin*, *83*(3).

MacKenzie, K., & Abaunza, P. (2014). Parasites as biological tags. in Cadrin, S.X., Kerr, L.A. & Mariani, S. (Eds) Stock identification methods. *San Diego, Academic Press*, *2*, 185–203.

Mele, S., Macías, D., Gómez-vives, M. J., Garippa, G., Alemany, F., & Merella, P. (2012). Metazoan parasites on the gills of the skipjack tuna *Katsuwonus pelamis* (Osteichthyes: Scombridae) from the Alboran Sea (western Mediterranean Sea). *Diseases of Aquatic Organisms*, *97*, 219–225. doi: 10.3354/dao02421

Mele, S., Pennino, M. G., Piras, M. C., Macías, D., Gómez-vives, M. J., Alemany, F., … Merella, P. (2016). Ecology of the Atlantic black skipjack *Euthynnus alletteratus* (Osteichthyes: Scombridae) in the western Mediterranean Sea inferred by parasitological analysis. *Parasitology*, *143*, 1330–1339. doi: 10.1017/S0031182016000792.

Mele, S., Saber, S., Gómez-Vives, M. J., Garippa, G., Alemany, F., Macías, D., & Merella, P. (2014). Metazoan parasites in the head region of the bullet tuna *Auxis rochei* (Osteichthyes: Scombridae) from the western Mediterranean Sea. *Journal of Helminthology*, 1–6. doi: 10.1017/S0022149X14000662

Melo, F. T. de V., Silva, J. P. e, Gonçalves, E. C., Furtado, A. P., Giese, E. G., Santos, C. P., & Santos, J. N. (2013). Taxonomic status and redescription of the genus *Brasicystis* Thatcher, 1979 (Digenea: Didymozoidae). *Parasitology International*, *62*(2), 208–214. doi: 10.1016/j.parint.2013.01.001

Mladineo, I., Žilić, J., & Čanković, M. (2008). Health survey of Atlantic Bluefin Tuna, *Thunnus thynnus* (Linnaeus, 1758), Reared in Adriatic Cages from 2003 to 2006. *Journal of the World Aquaculture Society*, *39*(2), 281–289. doi: 10.1111/j.1749-7345.2008.00156.x

Pozdnyakov, S. E., & Gibson, D. I. (2008). Family Didymozoidae Monticelli, 1888. In: Bray, R.A., Gibson, D.I., Jones, A. (Eds.), Keys to the Trematoda, 3. *CABI, UK, London*, 631–734.

Ruiz-Torres, N., García-Prieto, L., Lagunas-Calvo, O., Violante-González, J., & Osorio-Sarabia, D. (2017). Helminth infracommunity of the cane toad *Rhinella marina* (Anura: Bufonidae) within its native distribution range. *Parasitology International*, *66*(5), 567–572. doi: 10.1016/j.parint.2017.05.002

Whiteman, N. K., & Parker, P. G. (2005). Using parasites to infer host population history: a new rationale for parasite conservation. *Animal Conservation*, *8*, 175–181. doi: 10.1017/S1367943005001915