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Short Communication

Haliotrema aurigae (Yamaguti, 1968) Plaisance, Bouamer & Morand, 2004, in ornamental reef fish imported into Brazil

Haliotrema aurigae (Yamaguti, 1968) Plaisance, Bouamer & Morand, 2004, em peixe ornamental de recife importado para o Brasil

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Abstract

More than 1.450 marine fish species are commercialized as ornamental fish and approximately 90% of these are wild-caught. Rainford's butterflyfish, *Chaetodon rainfordi* (McCulloch, 1923), is endemic to the western Pacific. This fish species belongs to one of the main ornamental fish families imported into Brazil. *Haliotrema* is a genus of the family Dactylogyridae. Species of this genus have very interesting host associations and geographic distributions. The aim of this study was to report on occurrences of exotic *Haliotrema aurigae* in diseased Rainford butterflyfish that were imported to Brazil. One Rainford's butterflyfish with suspected parasitic disease was euthanized and subjected to skin and gill scraping. The parasite specimens were mounted on semi-permanent slides with Hoyer's solution for morphological analysis of sclerotized structures. The hard-sclerotized structures of these specimens were compared and were identified as those of *Haliotrema aurigae* (Yamaguti, 1968). These results emphasize the importance of implementation of correct control measures at the country's borders, to avoid the introduction of exotic parasites. In addition, it can be emphasized that the easy adaptation of this parasite to new environments is a concern for ornamental fish farmers.

Keywords: Aquatic health, parasitic disease, exotic parasite.

Resumo

Mais de 1.450 espécies de peixes marinhos são comercializados como peixes ornamentais e, aproximadamente, 90% são extraídos na natureza. O peixe borboleta Rainford, *Chaetodon rainfordi* (McCulloch, 1923), é endêmico no Pacífico Ocidental. Esta espécie de peixe pertence a uma das principais famílias importadas para o Brasil. *Haliotrema* é um gênero da família Dactylogyridae. Espécies desse gênero têm associação com hospedeiros e distribuição geográfica. O objetivo deste estudo é relatar a ocorrência de *Haliotrema aurigae* exótico, em peixes-borboleta doentes, que foram importados para o Brasil. Um peixe-borboleta Rainford, suspeito de estar infectado com doença parasitária, foi eutanasiado e submetido à raspagem de pele e brânquias. As amostras foram montadas em lâminas semipermanentes com Hoyer, para análise morfológica de estruturas esclerotizadas. A morfologia e as estruturas esclerotizadas duras das amostras foram comparadas e identificadas como *Haliotrema aurigae* (Yamaguti, 1968). Esses resultados enfatizam a importância da implementação de medidas de controle pós-fronteira para evitar a introdução de parasitas exóticos no país. Além disso, pode-se enfatizar que a fácil adaptação do parasita a um novo ambiente é uma preocupação para os pscicultores ornamentais.

Palavras-chave: Saúde aquática, doença parasitária, parasita exótico.

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With the growth of fishkeeping in Brazil, trading imported ornamental fish has gained importance over the years. In 2014, the aquarium market had a turnover of more than 18 million dollars, putting the country among the eight largest exporters in the world (Dey, 2016). Fifteen percent of these exported fish were marine fish. Although keeping marine fish is expensive, the demand for these fish has grown through new technologies that have arisen to facilitate the maintenance of saltwater aquariums. However, exporting and importing of ornamental fish can lead to invasion of exotic species and may pose risks to local biodiversity (Lymbery et al., 2014). The ornamental fish trade is characterized by aggregation of fish species from several countries. More than 1.450 marine fish species are commercialized as ornamental fish and approximately 90% of these are caught from the wild environment. Thus, many pathogenic agents may be transferred with the translocated fish, thus leading to outbreaks of diseases (Whittington & Chong, 2007).

The family Chaetodontidae comprises 131 species of marine fish, which preferentially inhabit the coral reefs of the Pacific Ocean (Tiralongo et al., 2018). Known as butterflyfish, these fish species are characterized by their bright colors and, hence, are highly coveted by aquarists around the world (Affonso & Galetti., 2007).

Rainford's butterflyfish, *Chaetodon rainfordi* (McCulloch, 1923), is an endemic species from the Western Pacific. Its natural range is limited to the Great Barrier Reef of Australia and coastal areas adjacent to Lord Howe Island. These fish feed on algae and small benthic invertebrates (Froese & Pauly, 2019) and belong to one of the main ornamental families imported into Brazil and the rest of the world (Gasparini et al., 2005; Lawton et al., 2013).

Monogeneans are parasites in the phylum Platyhelminthes that are normally found in fish species and lower invertebrates. Among the 13 families of monogeneans, four are frequently pathogenic to fish: Gyrodactylidae, Dactylogyridae, Ancyrocephalidae and Capsalidae (Reed et al., 2012). Species of the genus *Haliotrema* Johnston and Tiegs 1922; (Monogenea: Ancyrocephalinae) have very interesting host associations and geographic distributions. They are reputed to be highly host-specific and are found exclusively on marine percomorph fish in tropical and subtropical waters, associated with coral reef environments (Klassen, 1994).

The present study report on occurrences of exotic *Haliotrema aurigae* in diseased Rainford's butterflyfish (*C. rainfordi*) that were imported. These parasites may have been introduced together with their hosts into Brazil. The importance of implementation of correct control measures at the country's borders, in order to avoid the introduction of exotic parasites, is emphasized.

Six Rainford's butterflyfish (*C. rainfordi*) were imported from Australia on November 22, 2018. These fish were quarantined for 8 days; they showed no clinical signs of infection and were then released for commercialization.

They were transferred into a water recirculation system with a usable volume of 5.000 L, in which they joined other fish belonging to the company that imported them. These fish were fed three times a day with commercial feed (Tetra® marine flakes and granules, Germany) until they stopped eating, i.e. until they reached satiety. The water quality parameters were measured daily and were maintained as follows: temperature, 26 °C; salinity, 29 g L^{-1}; dissolved oxygen, 5 mg L^{-1}; alkalinity, 160 mg L^{-1}; pH, 8.2; and total ammonia concentration, < 0.1 mg L^{-1}.

These butterflyfish specimens were then released into a reef aquarium without displaying any clinical signs. However, six days after the release, a veterinary technician working for the retailer observed that one of them exhibited behavioral changes such as flashing, darkening (Figure 1), prostration and low mobility. This fish was dying, and infection with some form of parasitic disease was suspected. It was anesthetized with eugenol (75 mg L^{-1}) (Roubach et al., 2005) and euthanized by sectioning the spine (Noga, 2010), and was then subjected to skin and gill scraping.

The gills were removed from the fish specimen and monogenean parasites were collected manually using sterilized forceps. The parasite specimens were then mounted on semi-permanent slides with Hoyer's solution for morphological analysis of sclerotized structures (Kritsky et al., 1995). Photomicrographs were obtained using a differential interference contrast (DIC) microscope (Zeiss Axio Imager A2). The morphology and the hard-sclerotized structures of the specimens were compared with the descriptions given by Plaisance et al. (2004).

The specimens of monogeneans that were collected from the gills (Figure 2A) of this specimen of Rainford's butterflyfish (*C. rainfordi*) were identified as *Haliotrema aurigae* (Yamaguti, 1968). A male copulatory complex was the determinant structure in this differentiation; characterized by a trapezoidal base and an elongated accessory structure, with apparent filaments at its posterior extremity (Figure 2B). In addition, in the haptor, a transverse marking on the appendix, in the medial portion of the dorsal anchor, was observed (Figure 2C). Both of these characteristics were concordant with the description provided by Plaisance et al. (2004).

Figure 1. Rainford's butterflyfish (*Chaetodon rainfordi*) parasitized by *Haliotrema aurigae.*

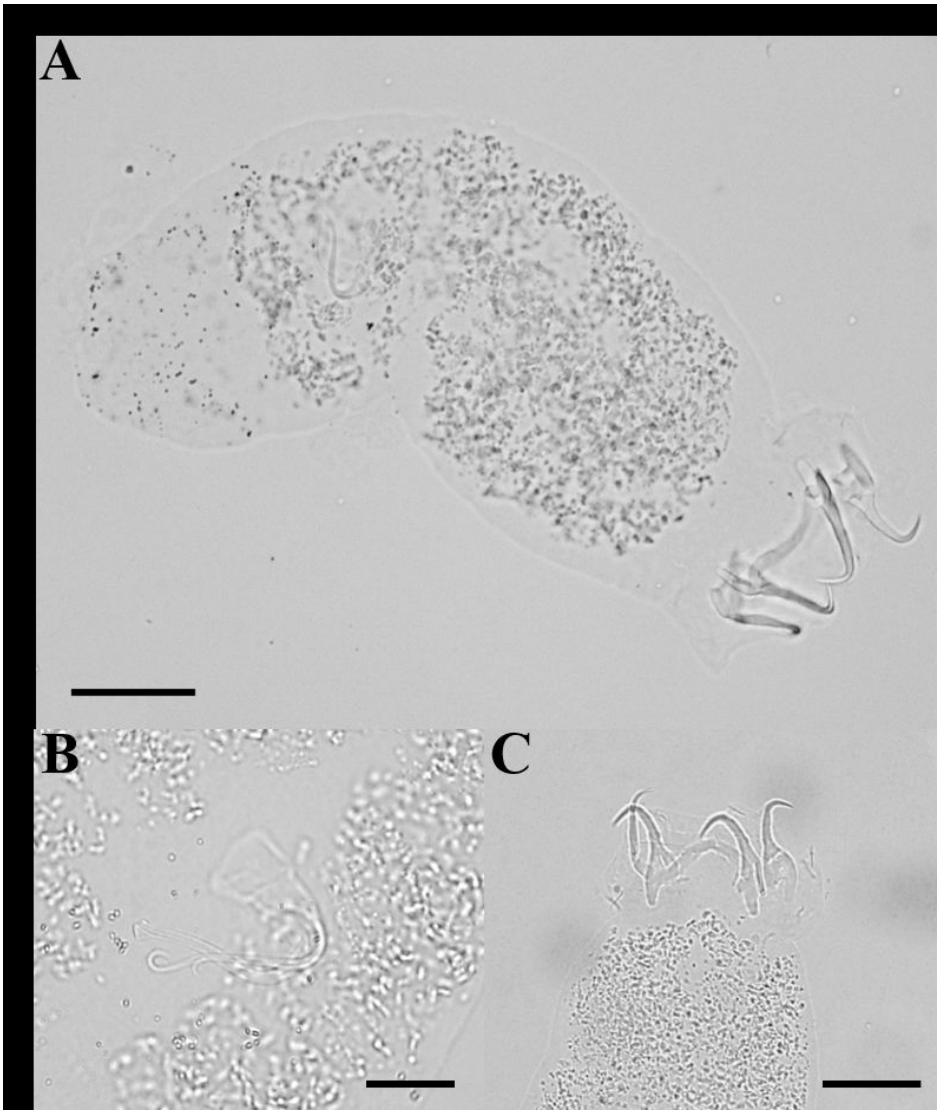

Figure 2. Photomicrographs of *Haliotrema aurigae* collected from *Chaetodon rainfordi* imported from Australia: (A) scale bar = 5 µm; (B) male copulatory organ (scale bar = 2 µm); (C) haptor (scale bar = 5 µm).

Previously described in the genus Pseudohaliotrema, the species was considered by Plaisance et al. (2004) as belonging to *Haliotrema*. In our study, we observed important characteristics relating to the sclerotized structures of monogenean parasites of Rainford's butterflyfish, which had not been collected in Brazil until now. Furthermore, these parasites were assigned to the genus *Haliotrema* Johnston and Tiegs, 1922. The specimens presented a straight or slightly curved penis, a trapezoidal base to the male copulatory complex and a simple filamentary accessory piece, among other morphological specifications.

Until now, the distribution of *H. aurigae* had been reported to be limited to the southern Pacific Ocean, on the outskirts of islands with coral reefs, preferentially parasitizing the family Chaetodontidae (Mizelle & Kritsky, 1969; Plaisance & Kritsky, 2004; Plaisance et al., 2004). There are 131 recognized species of *Haliotrema*, and *H. aurigae* had previously been reported in Rainford's butterflyfish only once, by Reverter et al. (2016) on the Indo-Pacific coast. The occurrence in Brazil in the present study is reported. These findings provide important information that can be used by aquarists in treating this parasitic infection of ornamental fish under confined conditions.

Parasite control measures are not implemented by importers after the fish have crossed the Brazilian border because of the lack of epidemiological data on fish diseases and asymptomatic carriers. This increases the risk of diseases in native fish and subsequent economic loss. There is a need for importers of ornamental fish to implement biosecurity measures at their facilities to prevent the introduction and dissemination of diseases caused by parasites such as monogenean worms. The quarantine period for fish in Brazil is only seven days (Brasil, 2019), which is not sufficient in most cases to detect or eliminate etiological agent(s) (Whittington & Chong, 2007).

Considering the losses caused by monogeneans in fish and the transborder potential of *Haliotrema* sp., it is necessary not only to optimize management practices but also to implement biosecurity measures that enable rapid and accurate diagnosis. This will help minimize the risk of economic losses and introduction of new diseases in this country. In this report, we detected gill infestation by monogeneans in the ornamental reef fish, Rainford's butterflyfish. This finding emphasizes the importance of implementation of correct control measures by importers at the country's border, in order to avoid the introduction of exotic parasite species into this country. It is important to emphasize that parasites that have specific host associations and geographic distributions were able to survive in the new aquarium without a coral reef environment in Brazil.

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