NEW HOSTS AND DISTRIBUTION RECORDS OF *BRAGA PATAGONICA*, A PARASITE CYMOTHOIDAE OF FISHES FROM THE AMAZON

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ABSTRACT

Tavares-Dias, M; Araújo, C. S. O.; Barros, M. S. & Viana, G. M. (2014) New hosts and distribution records of Braga patagonica, a parasite cymothoidae of fishes from the Amazon. Braz. J. Aquat. Sci. Technol. 18(1): 91-97. eISSN 1983-9057. DOI: 10.14210/bjast.v18n1.p91-97 Specimens of *Braga patagonica* Schiödte & Meinert, 1884 (Isopoda: Cymothoidae) from freshwater fishes deposited in Ichthyological Collection of Amazon National Research Institute (INPA), in central Amazon and from fishes from eastern Amazon (Brazil) were investigated. Prevalence, infection intensity and body measures of *B. patagonica* for different populations of this cymothoid in wild fishes species from Amazon were carried out. Four species of Serrasalmidae, one Characidae, one Cichlidae, one Cynodontidae, one Curimatidae, one Acestrorhynchidae and one Sciaenidae were recorded as new hosts for *B. patagonica* in the Amazon. This study indicates a low intensity and low parasitic specificity of *B. patagonica*, and also recorded the first parasitism by this ectoparasite in farmed *Colossoma macropomum*, describing its highly pathogenic effect.

Keywords: Crustacean, Cymothoid, Freshwater fish, Parasitism

INTRODUCTION

There are many crustacean parasites of fish in fresh, brackish and salt water, and most of them are found in natural fish populations. Isopod parasites are predominantly associated with marine fish species and only a few of them attack freshwater fish. Isopods of the family Cymothoidae Leach, 1818 covers more than 200 species, all well adapted to parasitism (see Piasecki & Avenant-Oldewage 2008). Currently, a total of 28 ectoparasite isopods representing 12 genera are known to attack South American freshwater fish and most of them belong to the family Cymothoidae (Carvalho et al., 2004). South America has a greater diversity of Cymothoidae species than any other region of the world (Thatcher, 2006; Eiras et al., 2010). In Brazil, Cymothoidae are the isopods most frequently found in freshwater fish (see Eiras et al., 2010). In terms of taxonomy, Cymothoidae is the least understood family within the suborder Flabellifera and requires a complex revision (Brusca, 1981). Before a revision being possible an extensive research effort is needed on individual species. One of the groups requiring detailed studies are Neotropical cymothoid fish parasites.

Among freshwater cymothoid species the genus *Braga* was proposed in 1881 to initially accommodate three new species from Brazil: *Braga cichlae* Shiödte & Meinert, 1881; *Braga nasuta* Shiödte & Meinert, 1881 and *Braga brasiliensis* Shiödte & Meinert, 1881. Later, Shiödte & Meinert, 1881 described a fourth species, the *Braga patagonica* from the Patagonia coast, near Rio Negro in Argentina. *Braga brasiliensis* was considered a synonym of *B. patagonica. Braga fluviatilis* Richardson, 1911 and *Braga bachmanni* Stadler, 1972 (see Lemos de Castro, 1959) were described in Argentina. In the eastern Amazon (State of Amapá), *Braga amapaensis* Thatcher, 1996 was described from *Acestrorhynchus microlepis* Jardine, 1841 (= *Acestrorhynchus guianensis* Menezes, 1969) (Acestrorhynchidae) (see Thatcher, 1996). Recently, *Braga cigarra* Thatcher, Oliveira & Garcia, 2009 was described parasitizing *Galeocharax knerii* Steindachner, 1879 (Characidae) from Rio Grande, in Minas Gerais, Brazil (Thatcher et al., 2009).

The aforementioned cymothoid species were reported as ectoparasites of freshwater fishes from South America (Thun & Brusca 1980; Brusca, 1981; Thatcher, 2006; Thatcher et al., 2009). However, there have been two erroneous reports on the occurrence of the cymothoids of the genus *Braga* in the west coast of the United States. *Braga occidentalis* Boone, 1918 was described, but no host was mentioned and it has been suspected that it was collected from eastern South America and later erroneously reported as being from North America (see Lemos de Castro, 1959; Thun & Brusca 1980; Brusca, 1981). Ho (1975) also reported *Braga* sp. from saltwater *Hypsopsetta guttulata* Girard, 1856 (Pleronectidae), in the coast of the United States (California), but the specimen is probably *Elthusa* sp. (Thun & Brusca, 1980).

A relationship between the increase in infestation intensity of *B. fluviatilis* and reduction of the *Dolops bidentata* Bouvier, 1899 (Branchiura) was observed in *Serrasalmus spilopleura* Kner, 1858 (Serrasalmidae) in Argentina (Hamann, 1995/1996). In Brazil, studies on the parasitic fauna of wild and farmed *Cichla* spp.

have reported the reference of *B. cichlae* in *Cichla temensis* von Humboldt, 1821 (Cichlidae) (Araújo et al., 2009). *Braga patagonica* has been reported parasitizing different species of freshwater fish (Lemos de Castro, 1959, Carvalho et al., 2004; Thatcher, 2006) in different environments. According to Lemos de Castro (1959), *B. patagonica* seems to be the most widespread isopod of this genus. Ectoparasites of the family Cymothoidae tend to be associated with their hosts through their entire life while species of other families are parasites only at their larval phase of life (Piasecki & Avenant-Oldewage, 2008).

The impact of these isopods on the health of fish is little known, but lesions in the gills are the most common (Eiras et al., 2010), as well as the low parasitic intensity. However, it may cause this impact mortality, or indirectly may act as vectors of diseases, especially those caused by virus (Carvalho et al., 2004, Thatcher 2006) and bacteria. In the gills of the red piranha *Pygocentrus nattereri* Kner, 1858 (Serrasalmidae) a tumor was found in the operculum, probably caused by *B. patagonica* (see Carvalho et al., 2004). Consequently, these infestations can cause significant economic losses in fish farms (Eiras et al., 2010), which have not been estimated yet. Few data on the infection and transmission rates of *B. patagonica* in Brazilian fish are found and there are no reports on farmed fish.

The aim of this study was to investigate the prevalence and intensity of *B. patagonica* in fish from the Ichthyological Collection of the Laboratory of Fish Parasitology from the Amazon National Research Institute (INPA), in central Amazon, Brazil. In addition, to report the first record of infestation in farmed fish.

MATERIAL AND METHODS

Fishes were obtained from the Ichthyological Collection of the Laboratory of Fish Parasitology of the Amazon National Research Institute (INPA). The fish collection grew for a period of over twenty years based on donations of a number of researchers. An important contribution was also the fish specimens collected within 1999–2000 with the intention to study parasitic isopods. The collection sites included: Tarumã Mirim Stream, a tributary of the Negro River (03º01'44.5"S, 060º09'49.1"W) and the Solimões River, near the Marchantaria Island, in the Amazonas River (03º14'29.4"S, 059º57'03.4"W). The paratypes of species described for the Amazon region and deposited in the Invertebrate Collection of INPA were also analyzed. The gills and mouths of all fish were examined, as well as their external surface, in order to verify the presence of Cymothoidae that pierce the peritoneal cavity. The parasite specimens found were processed for analyses under light microscopy, focusing on the morphological character of pleopods and mouth parts for identification.

In addition, *Colossoma macropomum* Cuvier, 1818 (980 to 1.816 g and 39 to 48 cm) were collected from a pond of 10,000m^3 containing 5,000 fish in a fish farm (0º02'31.4"S, 051º 07'34.4"W) from Macapá municipality, in the State of Amapá (in eastern Amazon, Brazil) for parasitological analysis. All fish had their external surface, mouth and gills examined for the presence of cymothoids. All the parasites found, in a total of 32 (24 males and 8 females) were collected and deposited in the INPA collection (Voucher: 1874), fixed in 70% ethanol and identified according to the recommendations of Lemos de Castro (1959) and Thatcher (2006).

RESULTS

A total of 33 females and 14 males from the Ichthyologic Collection of the Laboratory of Fish Parasitology from Amazon National Research Institute (INPA) deposited in the Invertebrate Collection under the vouchers in Table 1 were examined.

Braga patagonica Schiödte & Meinert, 1884
(Figure 1)

Diagnostic description

Females: oval body; light colored (closer to vert 340). Triangular cephalon, long and rounded anterior; long maxillipeds, with side lobes with hairy bristles and relatively small eyes (Table 2). Wide pereon, highest and widest at the 5th pereonite. Narrow pleon. Prominent pleotelson, wider than long. Uropod shorther than pleotelson; elongated oval branches; exopodite longer than endopodite.

Males: Smaller than females (Table 2), cephalon and pleon relatively larger than females in proportion to their bodies. Sexual dimorphism evident in the maxilliped, through shape and size and in the second pleopod with a slender male appendix.

Hosts

Tambaqui *Colossoma macropomum* Cuvier, 1818; red piranha *P. nattereri* Kner; pacu-manteiga *Mylossoma duriventre* Cuvier, 1817; redeye piranha *Serrasalmus rhombeus* Linnaeus, 1766 (Serralmidae); matrinxã *Brycon amazonicus* Spix and Agassiz, 1829 (Characidae); payara *Hydrolycus scomberoides* Cuvier, 1819 (Cynodontidae); South American silver croaker *Plagioscion squamosissimus* Heckel, 1840

Table 1 - Specimens of *B. patagonica* examined in Ichthyologic Collection of the Laboratory of Fish Parasitology from Amazon National Research Institute (INPA), State of Amazonas, Brazil.

Site of collection	Host species	Host family	Number of parasites	INPA Voucher
Tarumã-Mirim Stream, Negro River	*P. squamosissimus*	Sciaenidae	1 female	964
Catalão Lake, Solimões River	*P. squamosissimus*	Sciaenidae	2 females	1010
Jacaretinga Lake near Careiro Island, Solimões River	*P. nattereri*	Serrasalmidae	2 males	965 and 967
Jacaretinga Lake near Careiro Island, Solimões River	*P. nattereri*	Serrasalmidae	2 females	966 and 969
Jacaretinga Lake near Careiro Island, Solimões River	*P. nattereri*	Serrasalmidae	1 female, part in slide (number 78) and part in ethanol	970
Jacaretinga Lake near Careiro Island, Solimões River	*P. nattereri*	Serrasalmidae	1 female, part in slide (number 83) and part in ethanol	972
Jacaretinga Lake near Careiro Island, Solimões River	*P. nattereri*	Serrasalmidae	1 female	971
Passarinho Lake, near Careiro Island, Solimões River	*P. nattereri*	Serrasalmidae	4 females	973-975 and 984
Passarinho Lake, near Careiro Island, Solimões River	*P. nattereri*	Serrasalmidae	5 males, part in slide (number 90) and part in ehtanol	978-982
Passarinho Lake, near Careiro Island, Solimões River	*P. nattereri*	Serrasalmidae	5 males, part in slide (number 90) and part in ehtanol	978-982
Passarinho Lake, near Careiro Island, Solimões River	*C. macropomum*	Serrasalmidae	1 female, part in slide (number 113) and part in ethanol	983
Inema Lake, near Careiro Island, Solimões River	*P. nattereri*	Serrasalmidae	1 female, part in slide (number 29) and part in ethanol	986
Inema Lake, near Janauacá, Solimões River	*P. nattereri*	Serrasalmidae	5 females, part in slide (number 106) and part in ethanol	987-990 and 992
Solimões River, near Careiro Island	*P. nattereri*	Serrasalmidae	1 female, part in slide (number 100) and part in ethanol	1005
Solimões River, near Careiro Island	*P. nattereri*	Serrasalmidae	1 female, part in slide (number 101) and part in ethanol	1006
Inema Lake, near Janauacá, Solimões River	*P. nattereri*	Serrasalmidae	1 male, part in slide (number 110) and part in ethanol	991
Janauacá Lake, Solimões River	*Serrasalmus* sp.	Serrasalmidae	1 male, 1 female, part in slide (number 27a,b) and part in ethanol	993
Janauacá Lake, Solimões River	*Serrasalmus* sp.	Serrasalmidae	1 male	994
Janauacá Lake, Solimões River	*P. nattereri*	Serrasalmidae	1 female, part in slide (number 102) and part in ethanol	995
Solimões River, near Marchantaria	*P. nattereri*	Serrasalmidae	1 female, part in slide (number 103) and part in ethanol	996, 1000 and 1001
Catalão Lake, Solimões River	*P. nattereri*	Serrasalmidae	2 females	1011-1012
Catalão Lake, Solimões River	*P. nattereri*	Serrasalmidae	1 male	1013
Gamboa Lake near Careiro Island, Solimões River	*P. nattereri*	Serrasalmidae	1 female	1014
Solimões River, near Marchantaria Island	*S. rhombeus*	Serrasalmidae	1 male	997
Solimões River, near Marchantaria Island	*M. duriventre*	Serrasalmidae	1 female	998
Solimões River, near ilha da Marchantaria	*B. amazonicus*	Characidae	1 male	1002
Solimões River, near Marchantaria Island	*B. amazonicus*	Characidae	1 female	1004
Catalão Lake, Solimões River	*B. amazonicus*	Characidae	1 female, part in slide (number 112) and part in ethanol	1009
Solimões River, near Marchantaria Island	*C. orbicularis*	Cichlidae	1 male	1003
Solimões River	*H. scomberoides*	Cynodontidae	1 female	1007
Inema Lake, near Janauacá, Solimões River	*P. nattereri*	-	1 male	1008

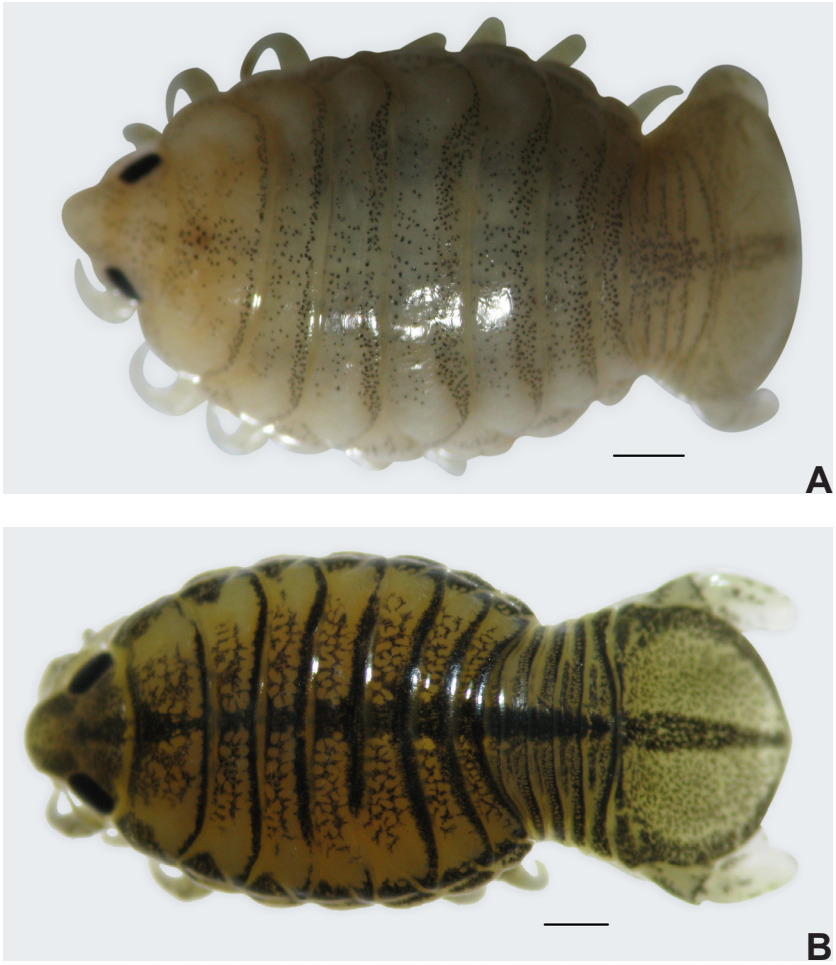

Figure 1 - *Braga patagonica* (A) female, (B) male, collected in Amazonian fish from the Ichthyologic Collection from INPA, central Amazon, Brazil. Bar: 1mm.

(Sciaenidae) and acará *Chaetobranchopsis orbicularis* Steindachner, 1875 (Cichlidae).

Site of attachment of the parasite

Mouth or ventral part of the gill chamber.

Localities of parasites collection

State of Amazonas, central Amazon, Brazil. Tarumã-Mirim Stream, Rio Negro; Jacaretinga Lake near Careiro Island, Solimões River; Passarinho Lake, near Careiro Island, Solimões River; Inema Lake, near Janauacá, Solimões River; Janauacá Lake, Solimões River near Marchantaria Island; Solimões River near Careiro Island; Catalão Lake; Gamboa Lake near Careiro Island in Solimões River (central Amazon).

State of Pará, eastern Amazon, Brazil. Cruz Alta Lake, Trombetas River (eastern Amazon).

Prevalence

Ichthyologic Collection: 4/10 299x100% =0.04%; Solimões River near Marchantaria Island: 22/514x100% = 4.28%; Tarumã-Mirim Stream, State of Amazonas: 2/158x100% = 1.26%.

Intensity of infection

1-2 parasites/host.

Specificity

Species of Amazonian cymothoid that presents the smallest parasitic specificity and found more frequently in Serrasalmidae species.

Type of hosts

Species of Loricaridae not identified; *Pogonias cromis* Linnaeus, 1766 (Sciaenidae); *Salminus hilarii* Géry, 1977 (Characidae) (Lemos de Castro, 1959; Thatcher, 1991, 2006); *Hoplias malabaricus* Bloch, 1794 (Erythrinidae) (Thatcher, 1991, 2006) and *P. nattereri* (Carvalho et al., 2004).

Type of locality

Coast of Patagonia, near Negro River in the Argentina, Assunção and Paraguai; São Francisco River in the States of Minas Gerais and Bahia; Belém in the State of Pará (Lemos de Castro, 1959) and Araguaia River in the State of Goiás, Brazil (Carvalho et al., 2004).

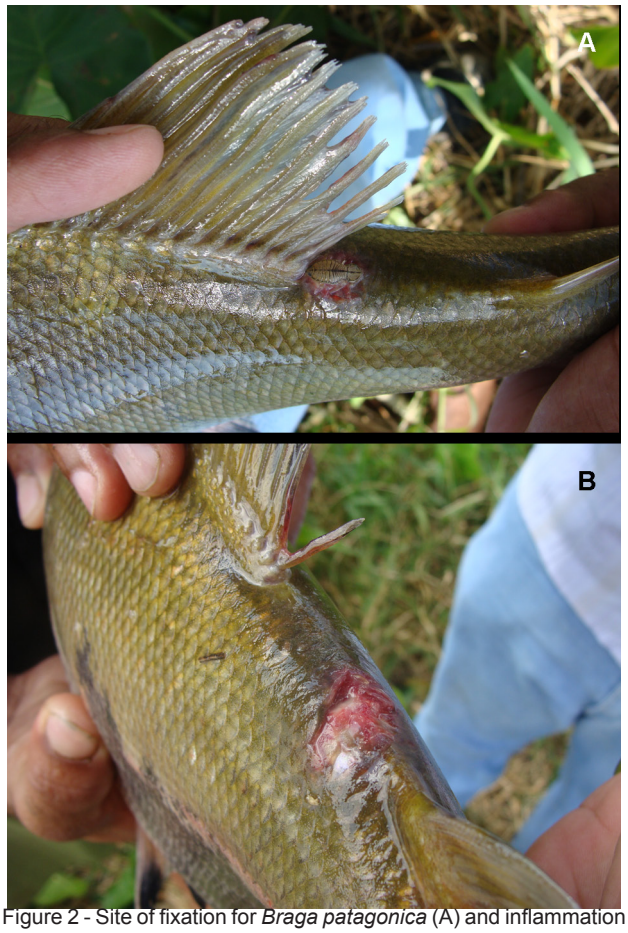

Figure 2 - Site of fixation for *Braga patagonica* (A) and inflammation at the site of attachment in farmed *Colossoma macropomum* (B) from the eastern Amazon, Brazil.

State of Amapá, eastern Amazon, Brazil. Infection in farmed fish species.

Out of 500 *C. macropomum* examined in one fish farm from the eastern Amazon, 30.0% had the body dorsal area parasitized by a specimen of this cymothoid (Figure 2A), which was always found near the fin. Body measurements of these crustacean parasites are shown in Table 3.

The attachment of the ectoparasites in this skin area of *C. macropomum* has probably facilitated its attachment and feeding and caused the destruction of the scales and inflammation at the site of attachment to the host (Figure 2B). Therefore, following the parasitological analysis and the collection of parasites, the tank was submitted to a treatment with 100g/1 000m^3 of Diflubenzuron, which eliminated the parasitism. After five days this tank was submitted to three consecutive treatments of salt (500g/m^3) for recovering the damages in the fish skin.

The source of parasitism indicated that the crustaceans *B. patagonica* were brought to the culture pond of *C. macropomum* by invader fish such as *H. malabaricus*, *Curimata cyprinoides* Linnaeus, 1766 (Curimatidae) and *Acestrorhynchus falcatus* Bloch, 1794 (Acestrorhynchidae). These fish invaded the culture ponds through the water supply of fish farm and *B. patagonica* was also found in the gills of these invading fish collected in the water supply channel of Fortaleza Stream, in areas near the fish farm, and a mean of 2 parasites per host were collected.

Table 2 - Measurements (mm) of males, females and transition of *Braga patagonica* of Amazonian fish from the Ichthyologic Collection from INPA, central Amazon, Brazil. L: length; W: width; N: number of examined specimens; SD: standard deviation

			N	Range	Mean	SD
Female	Body	L	33	13.91 - 24.31	18.20	2.55
		W	33	6.50 - 13.52	8.90	1.68
Male	Body	C	14	6.90 - 21.45	13.50	4.13
		W	14	3.04 - 11.31	6.30	2.52

Table 3 - Measurements (mm) of males, females and transition of *Braga patagonica* in farmed *Colossoma macropomum* from eastern Amazon, State of Amapá, Brazil. L: length; W: width; N: number of examined specimens; SD: standard deviation.

			N	Range	Mean	SD
Female	Body	L	8	12.53 - 18.27	15.89	1.74
		W	8	6.82 - 8.76	7.91	0.63
Male	Body	L	24	5.65 - 11.44	8.93	1.38
		W	24	2.36 - 5.37	4.00	0.68

DISCUSSION

Male cymothoid are free-living animals and female cymothoids are obligate parasites. They begin their lives as males and then turn into females (Araújo & Thatcher, 2006; Thatcher, 2006). For this reason, studies on *B. patagonica* have usually used only females for biometric measurements and taxonomic identification. Females of *B. patagonica* from the States of Amazonas and Pará had 18.2mm mean length and the males, 13.5mm, while females from the State of Amapá showed 15.89mm mean length and males, 8.93mm. Therefore, these results confirm that females are larger than males. Lemos de Castro (1959) cited that Schiödte & Meinert (1884) have recorded 20.0mm in length for the type specimen from the coast of Patagonia in Argentina, while Cordeiro (1937) reported 28.0mm in length and 16.0-16.5mm in width for two females collected in fish from the State of Pernambuco, Brazil.

A survey of crustaceans from the Sucuriju and Lakes regions in the State of Amapá, in the North Brazil, has reported the occurrence of *B. patagonica* in the marginal and aquatic vegetation of the floodplain forest (Vieira, 2006). This increases the parasitism possibility in fish that moves in areas of aquatic vegetation.

The pathogenicity of the ectoparasite isopods varies according to their location in the host, feeding behavior, strategy of attack and the parasite size

(Thatcher, 2006; Piasecki & Avenant-Oldewage, 2008; Eiras et al., 2010). Studies suggest that both, feeding sites and body size, probably play important role in the distribution and abundance of fish ectoparasites (Carvalho et al., 2004). For the most part, ectoparasite isopods of freshwater fish have well defined sites of attachment. Thatcher (2006) described that cymothoid species of the genus *Braga* infest the ventral part of the opercular cavity or the mouth of their hosts. In contrast, Carvalho et al. (2004) reported that the gills of *P. nattereri* were the attachment sites of *B. patagonica*. However, all farmed *C. macropomum* here examined had the dorsal region of the body as the only attachment site of *B. patagonica*.

In a fish farm from eastern Amazon, in the State of Amapá, 30.0% of the *C. macropomum* specimens were parasitized by *B. patagonica*, which caused the destruction of scales and a severe inflammation in the skin of this host. However, this infection in fish skin has been not yet documented, because the parasitism of gills is the most common (Eiras et al., 2010). In *P. nattereri*, from Araguaia River, the prevalence of *B. patagonica* was 88.8% and a tumor was found in the operculum, probably caused by the ectoparasite (Carvalho et al., 2004). This ectoparasite causes considerable injury to their hosts, once it seems to feed from mucous and epithelial cells, perforating the fish skin. Thus, they represent a major problem for Amazonian fish farms because they compromise the appearance of the fish intended to be commercialized. Nevertheless, the lesions of gills and a low parasitic intensity are the most common in wild fish populations. Since this infection on *C. macropomum* skin has been uncommon, further studies in other farmed fish species are need to understand the parasite-host-environment relationship.

In fish farm, to control infections by *B. patagonica* was used 100g/1 000m^3 of diflubenzuron in pond, which has eliminated this ectoparasite. In Brazil, this product has also been used to control other crustacean ectoparasites, because it has low toxicity to fish (Kreutz et al., 2008, Tavares-Dias et al., 2011). In order to be suitable for fish farming, a chemical product must be safe for fish, highly efficient and rapidly degraded, not interfering with the water, easily applicable and low cost.

In conclusion, this study indicates a low parasitic specificity of *B. patagonica*, besides enlarged the occurrence of this for new hosts in Brazilian Amazon such as the *C. macropomum*, *S. rhombeus*, *M. duriventre*, *S. spilopleura*, *B. amazonicus*, *C. orbicularis*, *H. scomberoides* and *P. squamosissimus*, from Trombetas River (State of Pará), Rio Negro, Solimões River and from several lakes and streams of the State of Amazonas, as well as *C. cyprinoide* and *A. falcatus* from State of Amapá. This is the first report of *B. patagonica* infecting and causing injury in farmed fish.

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