

ORIGINAL ARTICLE / ARTÍCULO ORIGINAL

TRINIBACULUM ALTIPARANAE SP. N., A NEW DACTYLOGYRID SPECIES (MONOGENEA) OF THE *ASTYANAX ALTIPARANAE* (OSTEICHTHYES: CHARACIDAE) IN THE PEIXE RIVER, SOUTHEASTERN BRAZIL

TRINIBACULUM ALTIPARANAE SP. N. UNA NUEVA ESPECIE DE DACTYLOGYRIDO (MONOGENEA) DE *ASTYANAX ALTIPARANAE* (OSTEICHTHYES: CHARACIDAE) EN EL RÍO PEIXE, SUDESTE DE BRASIL

Vanessa Doro Abdallah^{a*}, Rodney Kozłowski de Azevedo^a & Reinaldo José da Silva^b

^aUSC- Universidade Sagrado Coração, Bauru, São Paulo, Brasil, 17011-160

^bUNESP- Univ Estadual Paulista, Campus de Botucatu, Instituto de Biociências, Departamento de Parasitologia, Botucatu, São Paulo, Brasil, 18618-970
E-mail: vanessaabdallah@ig.com.br

Suggested citation: Abdallah, VD, Azevedo, RK & Silva, RJ. 2013. *Trinibaculum altiparanae* sp. n., a new Dactylogyrid species (Monogenea) of the *Astyanax altiparanae* (Osteichthyes: Characidae) in the Peixe river, Southeastern Brazil. *Neotropical Helminthology*, vol. 7, n°2, jul-dec, pp. 211 - 217.

Abstract

This article describes a new species –*Trinibaculum altiparanae* sp. n. –found in the gills of the *Astyanax altiparanae* Garutti & Britski, 2000. Fish were collected from the Peixe River in the municipality of Anhembi, State of São Paulo, Brazil, in March 2010. This paper describes the third species of the genus *Trinibaculum*. This new species is characterized by having an accessory structure that does not articulate with the male copulatory organ (MCO). This accessory structure has a basally bifid, well-curved distal end, tapered with a terminal flabellate piece. The male copulatory organ is a simple tube with less than one ring coiled counterclockwise; two similar curved dorsal bars; a ventral bar with concave ends and a posterior projection, a dorsal anchor with a truncated deep root and a slightly curved shaft, a ventral anchor with a curved shaft and differently shaped and sized hooks. Those features distinguish the new species from the two other species previously described in this genus: *Trinibaculum braziliensis* Kritsky, Thatcher & Kayton, 1980 was found parasitizing *Brycon melanopterus* (Cope, 1872) and *Trinibaculum rotundus* Karling, Lopes, Takemoto & Pavanelli, 2011 was found parasitizing *Schizodon borellii* (Boulenger, 1900).

key words: Ancyrocephalinae - *Astyanax altiparanae* - monogeneans - State of São Paulo - *Trinibaculum altiparanae* sp. n.

Resumen

Una nueva especie - *Trinibaculum altiparanae* sp. n. - se describe de las branquias de *Astyanax altiparanae* Garutti & Britski, 2000. Los peces fueron recolectados en el río Peixe en el municipio de Anhembi, São Paulo, Brasil, en marzo del 2010. Esta es la tercera especie del género *Trinibaculum* que se describe. La nueva especie se caracteriza por tener una pieza accesoria no articulada al órgano masculino copulador (COM), basalmente bífida y curva, el extremo distal cónico con una pieza terminal flabelada. El órgano copulador masculino es un tubo simple y envuelto con menos de una vuelta en dirección hacia la izquierda; barras dorsales similares y curvadas; una barra ventral con extremo cóncavo y con proyección posterior; raíz del ánclora dorsal profunda y truncada y suavemente curvada; ánclora ventral curvada y ganchos con diferente forma y tamaño, que difiere de las otras dos especies previamente descritas en este género: *Trinibaculum braziliensis* Kritsky, Thatcher & Kayton, 1980 que parasita a *Brycon melanopterus* (Cope, 1872) y *Trinibaculum rotundus* Karling, Lopes, Takemoto & Pavanelli, 2011 que parasita *Schizodon borellii* (Boulenger, 1900).

Palabras clave: Ancyrocephalinae - *Astyanax altiparanae* - Estado de São Paulo - monogeneos - *Trinibaculum altiparanae* sp. n.

INTRODUCTION

Monogeneans are the most speciose and diversified group of ectoparasites in the neotropical actinopterygian fish (Cepeda & Luque, 2010). In Brazil, the parasite fauna has been described for only 17.3% of the fish species, indicating that the total parasite biodiversity of fish in the region is grossly underestimated at present (Luque & Poulin, 2007). Thus, additional efforts at carrying out studies on the biodiversity of such parasites are relevant. The Peixe River (48°06'38"W; 22°49'53.1"S) is a tributary on the left bank of the middle Tiete River Basin in the region of Barra Bonita, State of São Paulo, Brazil. The river originates in the municipality of Torre de Pedra, State of São Paulo, in the Basaltic Cuesta Botucatu Environmental Preservation Area and is a drainage basin corresponding to 584 km² running from North to South (Caramaschi, 1986). The *Trinibaculum* genus was originally described by Kritsky *et al.* (1980) and the type species (*Trinibaculum braziliensis* Kritsky, Thatcher & Kayton, 1980) was recorded parasitizing the gills of the *Brycon melanopterus* (Cope, 1872) in the Januacá Lake near the city of Manaus, State of Amazonas, Brazil. After that, the *Trinibaculum rotundus* (Karling, Lopes, Takemoto & Pavanelli, 2011) was described

parasitizing the gill filaments of *Schizodon borellii* (Boulenger, 1900) from the upper Paraná River floodplain by Karling *et al.* (2011). According to Kritsky *et al.* (1980), this genus differs from all other Ancyrocephalinae because it possesses two widely separated simple dorsal bars, a dextroventral vagina, confluent intestinal crura, and intercecal gonads. *Astyanax altiparanae* (Garutti & Britski, 2000), a South American species with relevant importance, is a small-sized species (less than 20 cm in length) found in all environments, but more abundant in rivers and channel (Agostinho *et al.* 1997), is considered a forage, serving as food for large-sized fish species, in addition to piscivorous mammals, reptiles, and birds that inhabit the floodplains of rivers in general (Hann *et al.* 1997).

This paper provides the description of a new species of *Trinibaculum*, a parasite found in the gills of the *A. altiparanae* in the State of São Paulo, Brazil.

MATERIALS AND METHODS

In March 2010, eight specimens of *A. altiparanae* were collected for the study of monogeneans found in the Peixe River

(22°49'53.1''S; 48°06'38''W) in the municipality of Anhembi, State of São Paulo, Brazil. Fish were collected using nylon monofilament gill nets with mesh sizes of 3 to 14 cm at 3 different sites on the river: river mouth, pond and river channel. The nets were deployed at 1700 and removed at 0700 the following day for a total exposure time of 14 hours. Each fish was placed in a separate plastic bag and kept in coolers until necropsy. The gills were removed and the gill arches were separated, then placed in a vial and flooded with hot water (60° C to 70° C). The vial was vigorously shaken to detach parasites from the gills. After one hour, absolute alcohol was added to the vials in order to fixate the monogeneans, second procedures of Boeger & Vianna (2006).

Some specimens were stained with Gomori's trichrome and mounted with Canada balsam and others were mounted using Gray and Wess' medium (Humason, 1979) for the study of sclerotized structures. Differential interference contrast microscopy (Leica DMLB 5000, Leica Microsystems, Wetzlar, Germany) was used for the morphologic examination. Measurements were obtained using a computerized image analysis system (LAS, Leica Microsystems). Measurements (in micrometers) were expressed as the mean \pm standard deviation followed by the range and the number of specimens measured in parentheses. The illustrations were made with the aid of a camera lucida mounted on a Leica DMLS microscope. Type specimens were deposited at Instituto Nacional de Pesquisas da Amazônia (INPA), Manaus, State of Amazonas, Brazil and at Coleção Helminológica do Instituto de Biociências de Botucatu (CHIBB), Botucatu, São Paulo, Brazil with numbers Holotype INPA 586, Paratypes INPA 587a, b; Paratypes CHIBB 052L, 053L and 054L.

RESULTS

Dactylogyridae Bychowsky, 1933
Ancyrocephalinae Bychowsky, 1937
Trinibaculum Kritsky, Thatcher & Kayton, 1980
Trinibaculum altiparanae sp. n.
(Figs. 1A-I; 2A-D)

Diagnosis (based on 12 whole-mounted worms, five stained with Gomori's trichrome and seven mounted using Gray and Wess' medium) - Body 340 ± 20.9 (309–397; n = 12) long, fusiform, robust; 86 ± 11.5 (70–94; n = 12) wide near gonad level. Smooth tegument. Cephalic lobes moderately developed; cephalic glands not observed. Eyes 4, posterior pair smaller; eye granules present near pharynx. Pharynx spherical, 17 ± 2.6 (13–24; n = 11) in diameter; short esophagus; intestinal ceca confluent posterior to testis. Short peduncle; oval haptor 39 ± 5.3 (32–50; n = 12) long, 60 ± 5.1 (53–63; n = 12) wide. Ventral anchor 37 ± 4.9 (36–39; n = 11) long, with superficial root more developed than deep root, curved shaft, short point, base 13 ± 1.6 (11–18; n = 11) wide. Dorsal anchor 10 ± 0.6 (8–12; n = 11) long, with elongated superficial root and truncated deep root, slightly curved shaft and point; base 7 ± 0.9 (6–9; n = 11) wide. Ventral bar 31 ± 1.9 (29–33; n = 12) long, slightly V-shaped, with concave ends, striated, with posterior projection. Similar curved dorsal bars, 11 ± 1.1 (9–14; n = 18) long. Hooks different in shape and size, pair 3, 4 and 7 equal, with curved shaft and point, dilated shank, FH loop about $\frac{1}{4}$ of shank length; pairs 1, 2, 5, and 6 equal, with tapered shaft and point, dilated shank, FH loop about $\frac{3}{4}$ shank length; hook pairs 3, 4 and 7– 17 ± 2.2 (13–20; n = 18) long, pairs 1, 2, 5, and 6– 10 ± 1.5 (8–11; n = 18). Gonads intercecal, overlapping. Testis postgermian, subspherical 13 ± 2.1 (10–15; n = 4) in diameter. Seminal vesicle a simple dilation of vas deferens; prostatic reservoir saccate. The male copulatory organ is a simple tube, curved with less than one ring, counterclockwise, 68 ± 10.6 (51–75; n = 9) long. Accessory piece 19 ± 3.1 (16–22; n = 9) long, non-articulated to MCO, bifid basally, with different ends, well curved, distal end tapered with terminal flabellate piece. Germarium sub-ovate 42 ± 6.9 (35–48; n = 4) long, 20 ± 2.7 (16–27; n = 4) wide, vagina dextroventral, heavily sclerotized, handcuff-shape. Vitellaria dense, random in trunk, but absent in the regions of the reproductive organs. Type host - *Astyanax altiparanae* Garutti and Britski, 2000 (Characiformes: Characidae). Site of infestation - Gills.

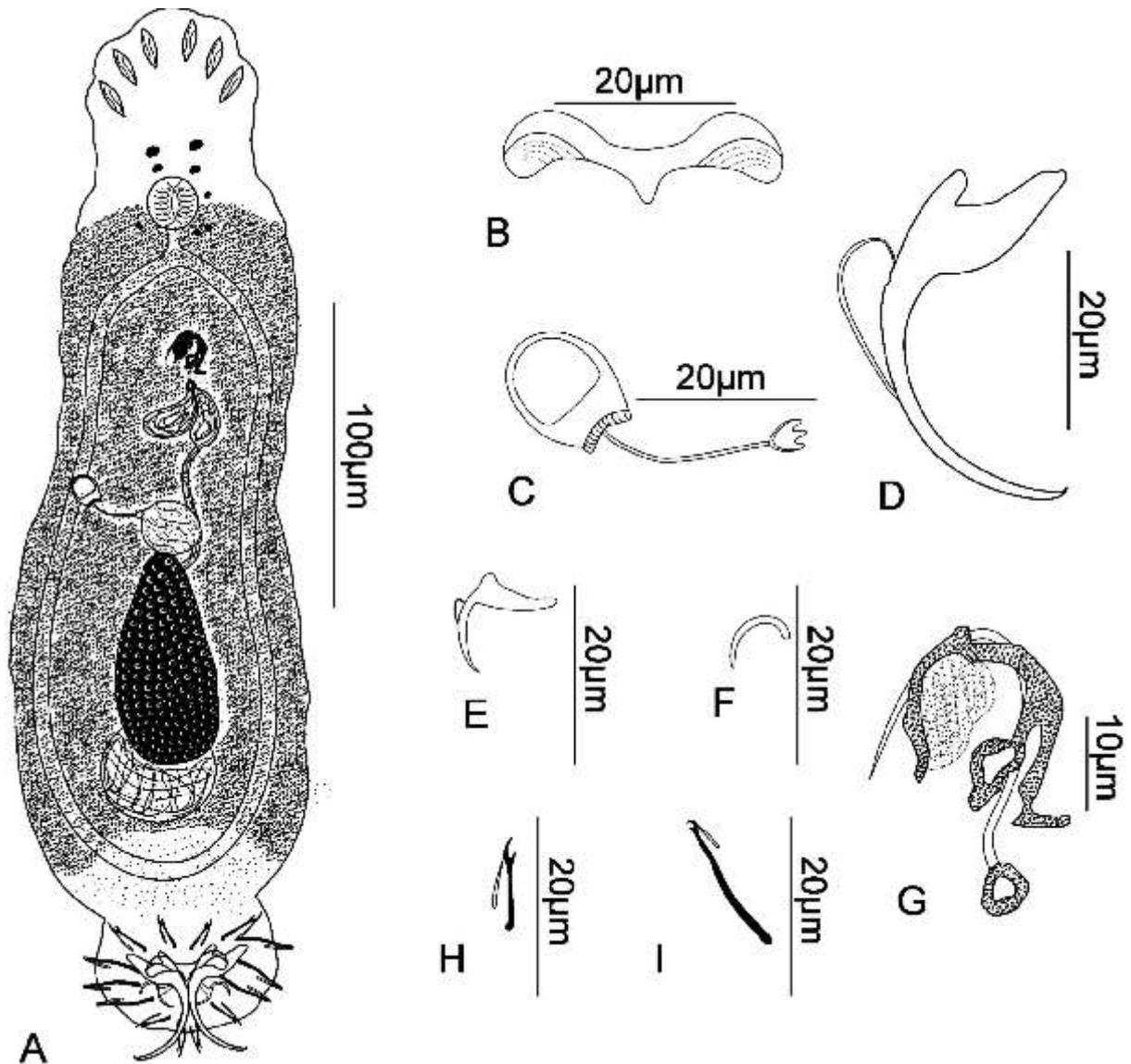


Figure 1. *Trinibaculum altiparanae* sp. n. (A) Whole worm, ventral view. (B) Ventral bar. (C) Vagina. (D) Ventral anchor. (E) Dorsal anchor. (F) Dorsal bar. (G) Male copulatory complex: MCO and accessory piece. (H) Hook pair 1. (I) Hook pair 3.

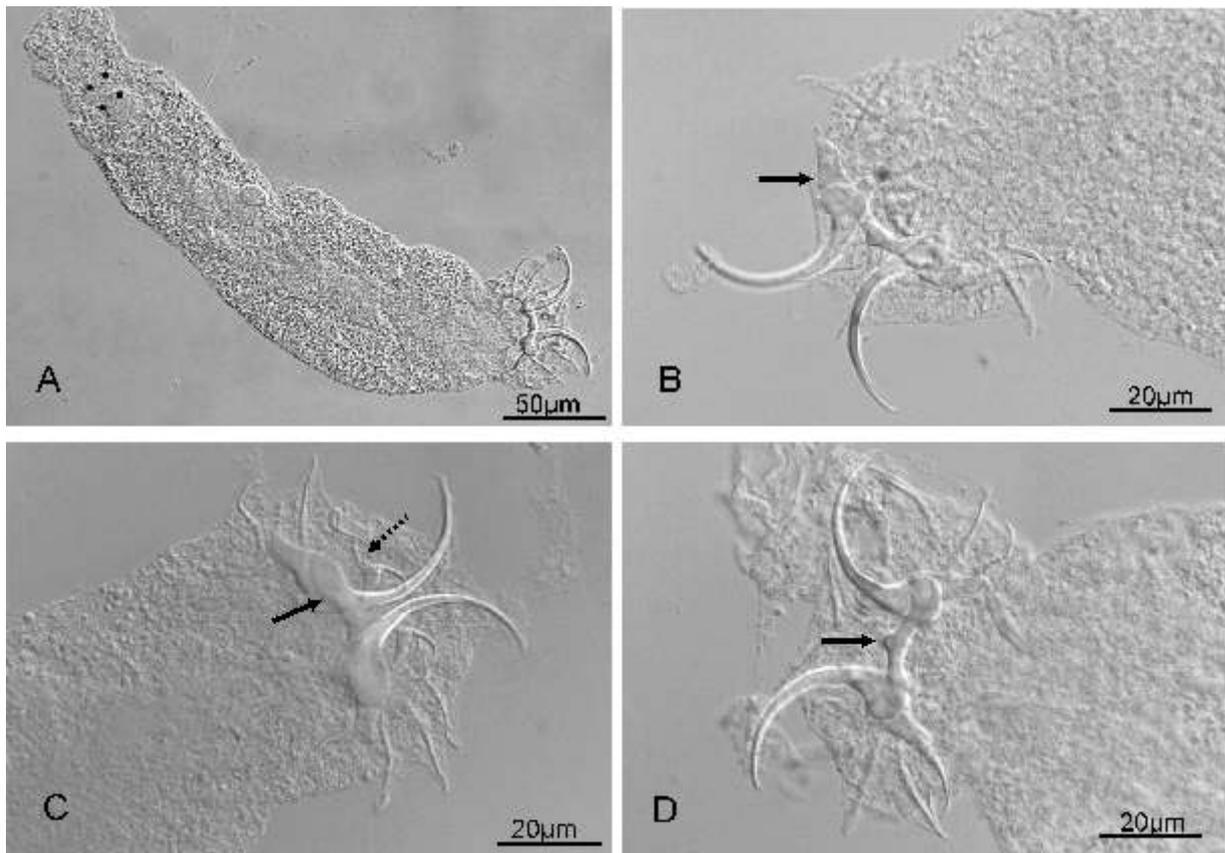


Figure. 2. *Trinibaculum altiparanae* sp. n. (A) Whole worm, ventral view. (B) Haptor showing ventral anchor (arrow). (C) Haptor showing striations on ventral bar (arrow) and dorsal anchor and bar (dotted arrow). (D) Haptor showing posterior projection in ventral bar (arrow).

Type locality - Peixe River (22°49'53.1"S; 48°06'38"W), municipality of Anhembi, São Paulo State, Brazil.

Prevalence: 50%

Mean Intensity: 2.4 ± 0.3

Specimens deposited - Holotype INPA 586, Paratypes INPA 587a, b; Paratypes CHIBB 052L, 053L and 054L.

Etymology - The specific designation *altiparanae* refers to the specific name of the type-host.

Taxonomic discussion - *Trinibaculum altiparanae* sp. n. differs from *T. braziliensis* in possessing the accessory piece non-articulated to MCO, bifid basally, well curved, distal end tapered with terminal flabellate piece (broadly articulated to proximal portion of male copulatory organ in *T. braziliensis*), ventral bar with posterior projection (without posterior

projections in *T. braziliensis*), dorsal anchor with truncated deep root and slightly curved shaft (dorsal anchor with spine-shaped deep root and short straight shaft in *T. braziliensis*), ventral anchor with curved shaft (ventral anchor with straight shaft in *T. braziliensis*), hooks different in shape and size (equal in *T. braziliensis*), shape of body fusiform (subtriangular in *T. braziliensis*) and gonads overlapping (tandem in *T. braziliensis*). The new species differs from *T. rotundus* in possessing the vagina dextroventral, heavily sclerotized, handcuff-shape (vagina dextrolateral slightly sclerotized ending at level of seminal receptacle in *T. rotundus*), male copulatory organ a simple tube, coiled with less than one ring, counterclockwise (copulatory organ coiled with 1.5 clockwise rings in *T. rotundus*), body fusiform and robust (body disk-shape with absence of haptor peduncle in *T.*

rotundus), peduncle present (absent in *T. rotundus*), ventral bar with posterior projections (without in *T. rotundus*) and hooks different in shape and size (equal in *T. rotundus*).

The new species presented here is allocated to *Trinibaculum* based on the main characters of the genus presented by Kritsky *et al.* (1980) and Boeger & Vianna (2006), i. e., gonads tandem, vagina dextro-ventral, ventral bar slightly V-shaped and dorsal bar double; anterior, posterior projections absent. However, the *Trinibaculum altiparanae* sp. n. presents three characteristics different of this genus: (i) an accessory piece not directly articulated to the MCO (also observed in the *Trinibaculum rotundus*); (ii) a ventral bar with posterior projection; and (iii) hooks that are different in shape and size - which can be perfectly justified because Kritsky *et al.* (1980) relied on the observation of a single species that was being described then, the *Trinibaculum braziliensis* to make the diagnosis of the genus.

ACKNOWLEDGMENTS

The authors would like to thank Ricardo Massato Takemoto from UEM (Universidade Estadual de Maringá) for providing slides of *Trinibaculum rotundus* for observation and comparison with our species and Elisa Pinto de Oliveira for editing the English. Vanessa D. Abdallah was supported by a student fellowship from FAPESP (2009/51726-6), Rodney K. de Azevedo was supported by a student fellowship from FAPESP (2010/06564-5), and Reinaldo José da Silva was supported by a Research fellowship from CNPq (312590/2009-1) and FAPESP(2009/53316-0).

BIBLIOGRAPHIC REFERENCES

- Agostinho, AA, Júlio Júnior, HF, Gomes, LC, Bini, LM & Agostinho, CS. 1997. *Composição, abundância e distribuição espaço-temporal da ictiofauna*. In: Vazzoler, AEAM, Agostinho, AA & Hahn, NSA. *Planície de inundação do alto rio Paraná: aspectos físicos, biológicos e socioeconômicos*. Maringá: EDUEM. p.179-208.
- Boeger, WA & Vianna, RT. 2006. *Monogenoidea*. In Thatcher, VE. *Amazon Fish Parasites*. Sofia: Pensoft Publishers. p.42-116.
- Caramaschi, EP. 1986. *Distribuição da ictiofauna de riachos das Bacias do Tietê e do Paranapanema, junto ao divisor de águas (Botucatu, SP)*. Tesis de Doctor en Ecologia e Recursos Naturais, Universidade Federal de São Carlos, São Carlos.
- Cepeda, PB & Luque, JF. 2010. *Three new species of Demidospermus (Monogenea: Dactylogyridae) parasitic on Brachyplatystoma filamentosum (Siluriformes: Pimelodidae) from the Araguaia River, Brazil*. Journal of Parasitology, vol. 96, pp. 869-873.
- Hahn, NS, Andrian, IF, Fugi, R & Almeida, VLL. 1997. *Ecologia trófica*. In: *A planície de inundação do Alto rio Paraná: aspectos físicos, biológicos e socioeconômicos*. (Eds. Vazzoler, AEAM Agostinho, AA & Hahn, NSA). pp. 209-228. Maringá: EDUEM.
- Humason, GL. (ed). 1979. *Animal tissue techniques*. W.H. Freeman Co., California.
- Karling, LC, Conceição Lopes, LP, Takemoto, RM & Pavanelli, GC. 2011. *Trinibaculum rotundus n. sp. (Monogenea, Ancyrocephalinae), a parasite of Schizodon borellii (Characiformes, Anostomidae) from the upper Paraná River floodplain, Brazil*. Helminthologia, vol. 48, pp. 85-87.
- Kritsky, DC, Thatcher, VE & Kayton, RJ. 1980. *Neotropical Monogenoidea. 3. Five new species from South America with the proposal of Tereancistrum gen. n. and Trinibaculum gen. n. (Dactylogyridae: Ancyrocephalinae)*. Acta Amazônica, vol. 10, pp. 411-417.
- Luque, JL & Poulin, R. 2007. *Metazoan parasite species richness in Neotropical fishes:*

Hotspots and the geography of biodiversity. *Parasitology*, vol. 134, pp. 865-878.

Received June 5, 2013.
Accepted September 6, 2013.

Correspondence to author/ Autor para correspondencia:
Vanessa Doro Abdallah

USC- Universidade Sagrado Coração, Bauru, São Paulo, Brasil. 17011-160
R. Irmã Arminda, 10050 - Vila Brunhari Bauru, 17011-160. Tel.: +55 11 21077297.

E-mail / Correo electrónico:
vanessaabdallah@ig.com.br