



Neotropical Helminthology



RESEARCH NOTE / NOTA CIENTÍFICA

FIRST RECORD IN BRAZIL OF AN *ERGASILUS* SPECIES (CYCLOPOIDA: ERGASILIDAE) PARASITIZING THE GILLS AND NASAL FOSSAE OF *RAPHIODON VULPINUS* (CHARACIFORMES: CYNODONTIDAE)

PRIMER REGISTRO EN BRASIL DE UNA ESPECIE DE *ERGASILUS* (CICLOPOIDA: ERGASILIDAE) PARASITANDO LAS BRANQUIAS Y FOSAS NASALES DE *RAPHIODON VULPINUS* (CHARACIFORMES: CYNODONTIDAE)

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ABSTRACT

Ergasilid species are found parasitizing the gills, fins, nasal fossae, tissues and urinary bladder of fishes. All *Ergasilus* species known in Brazil are cited as parasitizing only the gills of their hosts. Thirteen *Raphiodon vulpinus* (Characiformes: Cynodontidae) from Brazilian Amazon floodplain lakes were collected and analyzed. The copepod parasite *Ergasilus* sp. was found in the gills and nasal fossae of this fish. This is the first record in Brazil of an *Ergasilus* species parasitizing the gills and nasal fossae of the same host.

Key words: Copepoda – floodplain lakes – parasite – *Raphiodon vulpinus*

RESUMEN

Especies de Ergasilídeos son encontradas parasitando la branquias, aletas, fosas nasales, tejidos y vejiga urinaria de peces. Todas las especies de *Ergasilus* conocidas en Brasil son citadas parasitando sólo las branquias de sus hospederos. Trece *Raphiodon vulpinus* (Characiformes: Cynodontidae) provenientes de lagos inundables de la Amazonía brasileña fueron colectados y analizados. El copépodo *Ergasilus* sp. fue encontrado parasitando las branquias y fosas nasales de este pez. Este es el primer registro en Brasil de una especie de *Ergasilus* parasitando las branquias y fosas nasales de un mismo hospedero.

Palabras Clave: Copepoda – lagos inundables – parásito – *Raphiodon vulpinus*

INTRODUCTION

Copepods are common components in all types of fish assemblages, being present in all environments and ecosystems (Boxshall & Halsey, 2004). They are considered the largest and most diverse group of crustaceans and the most abundant among groups of multicellular organisms (Huys & Boxshall, 1991).

The Ergasilidae von Nordmann, 1832 is one of the biggest families in the order Cyclopoida Burmeister, 1835, with most species found on freshwater fishes. Only adult females of ergasilids are parasitic on gills, fins, inside the nasal fossae, embedded in host tissues or in the urinary bladder of actinopterygian fishes (Boxshall & Halsey, 2004).

The knowledge of the Ergasilidae fauna in the Americas is irregular, being the species from North America and Brazil in South America the ones with the best knowledge (Suárez-Morales *et al.*, 2008).

In Brazil 56 Ergasilidae species are known, being 13 genera and 45 species registered in the Amazon: *Acusicola* (7); *Amplexibranchius* (1); *Brasergasilus* (5); *Ergasilus* (16); *Gamidactylus* (3); *Gamispatulus* (1); *Gamispinus* (1); *Miracetyma* (3); *Pindapixara* (1); *Prehendorastrus* (2); *Rhinergasilus* (1); *Therodamas* (2) and *Vaigamus* (2) (Luque & Tavares, 2007).

Rhaphiodon vulpinus Spix & Agassiz, 1829 is popularly known as 'dourado-facão'. This species is widely distributed in South America, occurring in the basins of the Rivers Orinoco, Amazon, Paraná-Paraguay, Uruguay (Toledo-Piza, 2000) and the middle and upper Tocantins River (Neuberger *et al.*, 2007). It is a large, piscivorous species with significance for sport fishing and aquaculture (Graça & Pavanelli, 2007).

There are only three crustacean ectoparasites known from *R. vulpinus*: *Miracetyma kawa* Malta, 1993 from Rondônia State, Brazil (Malta, 1993); *Argulus multicolor* Stekhoven, 1937 and *Dolops carvalhoi* Lemos de Castro, 1949 from Lago Junuacá, Amazonas, Brazil (Malta, 1984).

All known ergasilid species associated with fishes from Brazil were registered parasitizing or the gills or the nasal fossae of their host (Luque & Tavares, 2007). This study records for the first time an *Ergasilus* species infecting the nasal fossae and gills of the same host.

MATERIAL AND METHODS

Thirteen specimens of *R. vulpinus* were collected and examined. Fish were captured in six floodplain lakes of the Brazilian Amazon between March and December 2013. The sampled lakes were: Baixio (03°17'27,2"S, 60°04'29,6"W); Preto (03°21'17,1"S, 60°37'28,6"W); Ananá (03°53'54,8"S, 61°40'18,4"W); São Tomé (03°49'39,0"S, 61°25'24,6"W); Araçá (03°45'04,3"S, 62°21'25,9"W) and Maracá (03°50'32,8"S, 62°34'32,4"W), all lakes located between the cities of Manaus and Coari in the State of Amazonas.

Copepod parasites were removed from the gill filaments and nasal fossae of the fish with dissecting needles and fixed in 70% ethanol. For taxonomic identification the parasites were transported to the Fish Parasitology Laboratory of the National Institute of Amazon Research (INPA), Manaus, Brazil. Voucher specimens were deposited in the invertebrate collection of the National Institute of Amazon Research (INPA), Manaus, Brazil. Voucher: INPA 2295.

The specimens were stained in 70% ethanol with small amounts of eosin and orange-G, dehydrated in pure phenol, cleared in methyl salicylate and mounted on microscope slides in Canada balsam (Thatcher, 2006). Drawings were prepared with the help of a light optical microscope with phase contrast using a camera lucida.

The prevalence of infection was calculated according to Bush *et al.* (1997): prevalence (P) is the number of infected fish with one or more individuals of a particular parasite species (or taxonomic group) divided by the number of hosts examined (expressed as a percentage).

RESULTS

The parasite identified was *Ergasilus* sp. (Figure 1). Morphological characters identified in this parasite assume that this copepod may be a new species.

Four-hundred seventy-five (475) specimens were registered parasitizing the gills (456 individuals collected in Lake Baixio, 17 in Lake Preto and 02 in Lake Ananá) with a prevalence of 69% and 12 in the nasal fossae of *R. vulpinus* (all in Lake Baixio) with a prevalence of 15%.

DISCUSSION

In Brazilian freshwater fishes, ergasilid species from *Brasergasilus* Thatcher & Boeger, 1983:

Gamidactylus Thatcher & Boeger, 1984, *Gamispatulus* Thatcher & Boeger, 1984; *Gamispinus* Thatcher & Boeger, 1984; and *Rhinergasilus* Boeger & Thatcher, 1988 are cited parasitizing the nasal fossae of their hosts (Thatcher & Boeger, 1983; 1984a, b, c; Boeger & Thatcher, 1988).

In Amazon floodplain lakes, the ergasilids *Gamidactylus jaraquensis* Thatcher & Boeger, 1984 *Rhinergasilus piranhus* Boeger & Thatcher, 1988; were registered infecting the nasal fossae of *Colossoma macropomum* (Cuvier, 1818) and *Serrasalmus altispinis* Merckx, Jégu & Santos, 2000 (Morey & Malta, 2016a, b), and *Therodamas elongates* Thatcher, 1986 was reported in the nasal fossae of *Astronotus crassipinis* (Heckel, 1840) (Morey et al., 2016).

Some *Ergasilus* species were found in the nasal fossae of different fish species: *Ergasilus*

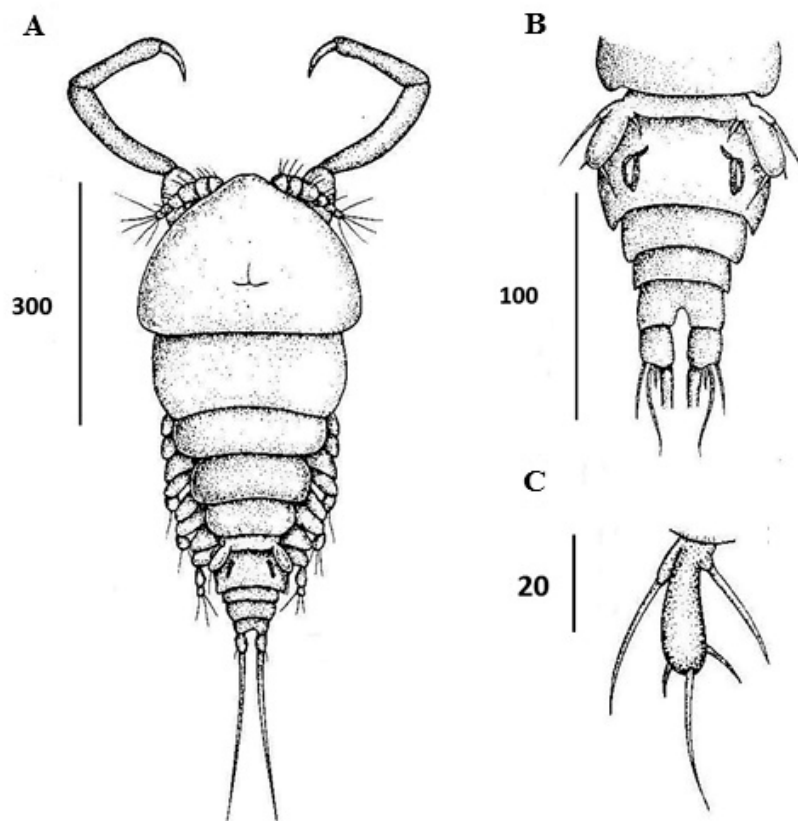


Figure 1. *Ergasilus* sp. from *Raphiodon vulpinus* Spix & Agassiz, 1829. A. whole specimen; B. abdomen and caudal rami, ventral view. C. Leg V. Scales are given in micrometers (μm).

myctarothus Wilson, 1913 from *Sphyrna zigaena* (Linnaeus, 1758) in Jamaica (Wilson 1913), *E. megaceros* Wilson, 1916 from *Ictalurus anguilla* (Leseur, 1819) in North America (Wilson 1916), *E. rhinus* Burris & Miller, 1972 from *Centrarchus macropterus* (Lacepède, 1801) *Lepomis gibbosus* (Linnaeus, 1758) and *L. auritus* (Linnaeus, 1758) (Burris & Miller, 1972).

For *Ergasilus*, 26 valid species plus 10 unidentified species have been reported infecting the gills of Brazilian fishes (Luque & Tavares, 2007) without any register of occurrence in the nasal fossae. This is the first report of an *Ergasilus* species parasitizing the gills and the nasal fossae of the same host in the Neotropical region.

Ergasilus sp. is very similar with *Ergasilus xinguensis* Taborda, Paschoal & Luque, 2016 by having the same ornamentations in the antenna, all endopods 3-segmented and the leg V constitute of a single segment, well developed. *Ergasilus xinguensis* was described from the gills of *Geophagus argyrostictus* (Kullander, 1991) (type host) and *G. altifrons* (Heckel, 1840) (Taborda et al., 2016).

The differences found between these two species are: the type host, site of infection, shape of the body and some ornamentations in different parts of the body. A comparative study between these two species is necessary in order to confirm or not if this copepod is in fact *E. xinguensis* or a new species of *Ergasilus*. Additionally, a detailed description of this parasite is being preparing for a future publication.

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BIBLIOGRAPHIC REFERENCES

- Boeger, WA & Thatcher, V. 1988. *Rhinergasilus piranhus* gen. et sp. nov. (Copepoda, Poecilostomatoida, Ergasilidae) from the Nasal Cavities of Piranha Caju, *Serrasalmus nattereri*, in the Central Amazon. Proceedings of the Helminthological Society of Washington, vol. 55, pp. 87-90.
- Boxshall, GA & Halsey, SH. 2004. *An introduction to copepod diversity*. 2nd ed. Ray Society, London. 966 pp.
- Burris, KW & Miller, CG. 1972. *Ergasilus rhinus* sp. n. (Copepoda: Cyclopoida) from the nasal fossae of three centrarchid fishes of North Carolina. *Journal of Parasitology*, vol. 58, pp. 600-604.
- Bush, AO, Lafferty, KD, Lotz, JM & Shostak, AW. 1997. *Parasitology meets ecology on its own terms: Margolis et al. revisited*. *The Journal of parasitology*, vol. 83, pp. 575-583.
- Dogiel, VA. 1961. *Ecology of the parasites of freshwater fishes. Parasitology of fishes*, In VA. Dogiel, GK. Petrushevski & Polyanski, YI. (eds.). *Parasitology of Fishes*. Oliver & Boyd, Edinburg, pp. 1-47.
- Graça, WJ & Pavanelli, CG. 2007. *Peixes da planície de Inundação do Alto Rio Paraná e áreas adjacentes*. Eduem, Maringá, 241 pp.
- Huys, R & Boxshall, G. 1991. *Copepod evolution*. The Ray Society, London. 468 pp.
- Luque, JL & Tavares, LE. 2007. *Checklist of Copepoda associated with fishes from Brazil*. *Zootaxa*, vol. 1579, pp. 1-39.
- Malta, JC. 1983. *Miracetyma kawa* sp. nov. (Copepoda, Poecilostomatoida, Ergasilidae) from Freshwater Fishes of the Brazilian Amazon. *Acta Amazonica*, vol. 23, pp. 251-259.
- Malta, JC. 1984. *Os peixes de um lago de várzea da Amazônia Central (Lago Janauacá, Rio Solimões) e suas relações com os crustáceos ectoparasitas (Branchiura: Argulidae)*. *Acta Amazonica*, vol. 14, pp. 355-372.
- Morey, GA & Malta, JC. 2016a. *Metazoários parasitas das narinas do tambaqui Colossoma macropomum (Cuvier, 1818) (Characiformes: Characidae) coletadas em lagos de várzea da Amazônia central, Brasil*. *Folia Amazonica*, vol. 25, pp. 71-76.
- Morey, GA & Malta, JC. 2016b. *As espécies de Copepoda (Crustacea: Ergasilidae) parasitas dos filamentos branquiais e narinas de Serrasalmus altispinis (Merckx, J é g u e S a n t o s , 2 0 0 0)*

- (Characiformes–Serrasalminae) em lagos de várzea do Brasil. *Folia Amazonica*, vol. 25, pp. 55-60.
- Morey, GA, Moreira, AC, Morais, AM, Atroch, FB, Santana, HP, Brandão, NR, Dumbo, JC, Vital, JF & Malta, JC. 2016. *Copepods (Crustacea: Ergasilidae) fish parasites of floodplain lakes of Central Amazon, Brazil*. *Neotropical Helminthology*, vol. 10, pp. 281–294.
- Suárez-Morales, E & Santana, AM. 2008. *A new species of Ergasilus (Copepoda: Cyclopoida: Ergasilidae) from coastal fishes of the Mexican Pacific*. *Folia parasitologica*, vol. 55, pp. 224-230.
- Taborda, NL, Paschoal, F & Luque, JL. 2016. *A new species of Ergasilus (Copepoda: Ergasilidae) from Geophagus altifrons and G. argyrostictus (Perciformes: Cichlidae) in the Brazilian Amazon*. *Acta Parasitologica*, vol. 61, pp. 549-555.
- Thatcher, VE. 2006. *Amazon fish parasites*. Pensoft Publishers, 2nd ed. Sofia-Moscow, 508 pp.
- Thatcher, VE & Boeger, WA. 1983. *The parasitic crustaceans of fishes from the Brazilian Amazon*. 5. *Brasergasilus* gen. nov. (Copepoda: Cyclopoida), a "three-legged" ergasilid, with two new species and the proposal of *Abergasilinae* subfam. nov. *Acta Amazonica*, vol. 13, pp. 195-214.
- Thatcher, VE & Boeger, WA. 1984a. *The parasitic crustaceans of fishes from the Brazilian Amazon*. 13. *Gamidactylus jaraquensis* gen. et sp. nov. (Copepoda, Poecilostomatoida, Vaigamidae) from the nasal fossae of *Semaprochilodus insignis* (Schomburgk). *Amazoniana limnologia et Oecologia Regionalis Systemae Fluminis Amazonas* vol. 8, pp. 421-426.
- Thatcher, VE & Boeger, WA. 1984b. *The parasitic Crustaceans of fishes from the Brazilian Amazon*, 15. *Gamispatulus schizodontis* gen. et sp. nov. (Copepoda: Poecilostomatoida: Vaigamidae) from the nasal fossae of *Schizodon fasciatus*. *Amazoniana*, vol. 9, pp. 119-126.
- Thatcher, VE & Boeger, WA. 1984c. *The parasitic crustaceans of fishes from the Brazilian Amazon*. 14. *Gamispinus diabolicus* gen. et sp. nov. (Copepoda, Poecilostomatoida, Vaigamidae) from the nasal fossae of *Ageneiosus brevifilis Valenciennes*. *Amazoniana limnologia et Oecologia Regionalis Systemae Fluminis Amazonas*, vol. 8, pp. 505-510.
- Toledo-Piza, M. 2000. *The Neotropical fish subfamily Cynodontinae (Teleostei: Ostariophysi: Characiformes): a phylogenetic study and a revision of Cynodon and Rhabiodon*. American Museum Novitates, New York, 88 pp.

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