



Checklist of Acanthocephala associated with the fishes of Brazil

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Abstract

Twenty-three genera comprising thirty-four named and thirteen undetermined species of acanthocephalans are associated with one hundred and nineteen marine, brackish and freshwater fish species from Brazil. These are listed, with information on their hosts, habitat, distribution and records. A key to these parasites at the generic level is provided.

Key words: Acanthocephala, biodiversity, checklist, freshwater and marine fishes, key, Neotropics, Brazil

Introduction

Studies on the phylum Acanthocephala in Brazil began with the naturalist Johann Natterer, who arrived in Brazil on the 5th of November of 1817. He was among the royal attendants accompanying the Austrian Archduchess Leopoldina, who came to marry the future Emperor of Brazil, D. Pedro I (Straube, 2000). Natterer participated in several expeditions, crossing the country from Rio de Janeiro to the Amazon, during a period of 18 years (1817–1835). The material which he collected was brought to the Brazilian museum in Vienna (actually the Naturhistorische Museum). Among this material were helminth parasites, including some acanthocephalans which were later studied by Karl Moritz Diesing (1851, 1856), who described several species, two of which were subsequently redescribed by Kritscher (1957, 1976) based on the original material.

In 1913 the Brazilian researcher Lauro Travassos started his helminthological studies with work on acanthocephalans from birds, and in 1923 he described *Echinorhynchus jucundus* Travassos, 1923 from the fish *Piaractus brachypomus* (Cuvier, 1818). During this period, Travassos (1917, 1926) carried out a taxonomic review of the acanthocephalans from Brazil. Subsequently, our knowledge of the Brazilian acanthocephalan fauna was significantly increased by the work of Domingos Machado Filho, a student of Travassos, who described numerous new genera and species (Machado Filho, 1941, 1948, 1951, 1954, 1959a, b). Among the researchers who have contributed to this fauna in recent years, the works of Vernon Thatcher (1991, 2006) are the most notable, as he listed the parasite species, including acanthocephalans, from fishes in the Amazon River basin, with keys, descriptions and accounts of their biology.

Here we provide a checklist of the acanthocephalan species associated with marine and freshwater fishes from Brazil. The information is presented as parasite-host and host-parasite lists, with a key to the generic level. We have attempted to include information from all published reports and have added a small number of original records.

Material and methods

The bibliographic review of the species of helminth parasites reported from fishes in Brazilian waters was based on information collected from two sources. Firstly, searches of the Host-Parasite Catalogue of the Natural History Museum in London for 1920 to 1997 and, for the years 1988–2003, the Host-Parasite Database, a partial implementation of which is now available on-line (Gibson *et al.*, 2005). Secondly, searches of the Zoological Record and CAB Abstract databases were made up to February 2008. In addition to these databases various other on-line searches were undertaken. Other works checked included published reports and papers based on original records. Original data from our own research are also included.

The checklist follows the parasite classification and systematic arrangement of Amin (1985, 1987, 2002). The Acanthocephala are arranged according to the class, order and family, within which the species are presented in alphabetical order. The host species are given followed by their predominant habitat (marine—MAR, freshwater—FW or brackish water—BW), localities and records (in chronological sequence). In addition, the checklist includes acanthocephalans recorded only to generic, familial or class level (undetermined species).

Acanthocephalan species names have been up-dated to agree with the recent literature, but inclusion in the parasite or host lists does not imply that the authors necessarily agree with their validity. The species of fish in the host-parasite list are arranged according to the higher level classification of Nelson (2006) and then in alphabetical order at the generic and species levels; the names used follow FishBase (Froese & Pauly 2008).

Results

In the present paper twenty-three genera comprising thirty-four named and thirteen undetermined species of acanthocephalans parasitising Brazilian fishes are listed. These worms were recorded from one hundred and nineteen marine, brackish and freshwater fish species.

Key to the genera of Acanthocephala from Brazilian fishes

- 1 Proboscis receptacle double-walled..... Class Palaeacanthocephala (2)
- Proboscis receptacle absent or single-walled..... (7)
- 2 Adult worms in intestine of fishes and amphibians..... Order Echinorhynchida (3)
- Larval worms encysted in tissues of fish; adults in birds and mammals.....
..... Order Polymorphida; Family Polymorphidae (9)
- 3 Cement glands 2 Family Diplosetidae (12)
- Cement glands more than 2 (4)
- 4 Trunk unarmed or with minute spines (5)
- Trunk armed with strong spines or plaques (6)
- 5 Cement glands 4 Family Cavisomidae; *Paracavisoma* Kritscher, 1957
- Cement glands 6–8 (13)
- 6 Trunk spined in single undivided anterior region Family Illiosentidae; *Dollfusentis* Golvan, 1969
- Trunk spined differently Family Rhadinorhynchidae (15)
- 7 Proboscis claviform, with numerous longitudinal rows of hooks; cement glands separate
Class Polyacanthocephala; Order Polyacanthorhynchida; Family Polyacanthorhynchidae; *Polyacanthorhynchus* Travassos, 1926

- Proboscis usually small, with few radial rows of hooks; cement gland single.. Class Eoacanthocephala (8)
- 8 Trunk armed..... Order Gyraacanthocephala; Family Quadrigyridae (17)
- Trunk unarmed..... Order Neoechinorhynchida; Family Neoechinorhynchidae (19)
- 9 Anterior part of trunk bulbous (10)
- Anterior part of trunk not bulbous (11)
- 10 Trunk spines end at same level *Bolbosoma* Porta, 1908
- Trunk spines extend more on ventral side *Corynosoma* Lühe, 1904
- 11 Trunk spines arranged in narrow band..... *Hexaglandula* Petrotschenko, 1950
- Trunk spines not arranged in narrow band *Polymorphus* Lühe, 1911
- 12 Proboscis short, globular; hooks vary in size and shape.....
..... *Amapacanthus* Salgado-Maldonado & Santos, 2000
- Proboscis long, claviform; hooks similar *Golvanorhynchus* Noronha, Fabio & Pinto, 1978
- 13 Proboscis long, with gradual transition from basal to apical hooks Family Echinorhynchidae (14)
- Proboscis short, with abrupt transition from basal to apical hooks
..... Family Arhythmacanthidae; *Heterosentis* Van Cleave, 1931
- 14 Trunk rotund; testes spherical, parallel or diagonal..... *Brasacanthus* Thatcher, 2001
- Trunk elongate; testes tandem *Echinorhynchus* Zoega in Müller, 1776
- 15 Trunk with cuticular combs on ventral surface..... *Serrasentis* Van Cleave, 1923
- Trunk without cuticular combs (16)
- 16 Proboscis long, frequently with basal hooks larger than others *Rhadinorhynchus* Lühe, 1911
- Proboscis short, without large hooks at base *Gorgorhynchus* Chandler, 1934
- 17 Trunk with 15 circular rows of spines different in size *Machadosentis* Noronha, 1992
- Trunk with 4–12 circular rows of similar spines (18)
- 18 Proboscis hooks in 6–12 oblique rows *Palliolisentis* Machado Filho, 1960
- Proboscis hooks in 3–4 circular rows *Quadrigyrus* Van Cleave, 1920
- 19 Proboscis hooks in 3 circular rows (20)
- Proboscis hooks in 8 diagonal rows of 8 hooks each *Floridosentis* Ward, 1953
- 20 Proboscis hooks in 3 circular rows of 6 hooks each..... (21)
- Proboscis hooks in 3 circular rows of more than 6 hooks each..... (22)
- 21 Muscular sling surrounds proboscis receptacle *Gorytocephalus* Nickol & Thatcher, 1971
- Muscular sling around proboscis receptacle absent *Neoechinorhynchus* Stiles & Hassall, 1905
- 22 Proboscis hooks in 3 circular rows of 12 hooks each..... *Gracilisentis* Van Cleave, 1919
- Proboscis hooks in 3 circular rows of 8 hooks each..... *Octospiniferoides* Bullock, 1957

Parasite-Host List

Class Palaeacanthocephala Meyer, 1931

Order Echinorhynchida Southwell & MacFie, 1925

Family Arhythmacanthidae Van Cleave, 1931

Heterosentis sp.—adult

Hosts and habitat: *Pinguipes brasilianus* (MAR), *Pseudoperca numida* (MAR)

Locality: Off Cabo Frio - Rio de Janeiro

References: Luque *et al.* (2008)

Family Cavisomidae Meyer, 1932

Paracavisoma impudicum (Diesing, 1851)—adult

Host and habitat: *Oxydoras kneri* (FW), *Oxydoras niger* (FW)

Locality: Upper Parana River/Paraná, Mato Grosso

References: Diesing (1851), Travassos *et al.* (1928), Kritischer (1957), Golvan (1969), Eiras *et al.* (1995), Rêgo and Vicente (1988), Thatcher (1991, 2006)

Family Diplosetidae Meyer, 1932

Amapacanthus amazonicus Salgado-Maldonado & Santos, 2000—adult

Hosts and habitat: *Anableps microlepis* (MAR), *Sciades passany* (MAR)

Locality: Off Maraca Island

References: Salgado-Maldonado and Santos (2000)

Golvanorhynchus golvani Noronha, Fabio & Magalhaes, 1978—adult

Host and habitat: *Scomber colias* (MAR)

Locality: Off Rio de Janeiro

References: Noronha *et al.* (1978)

Family Echinorhynchidae Cobbold, 1876

Brasacanthus sphaeroides Thatcher, 2001—adult

Host and habitat: *Sphaeroides greeleyi* (MAR)

Locality: Off Parana

References: Thatcher (2001)

Echinorhynchus briconi Machado Filho, 1959 (syn. *Metechinorhynchus briconi*)—adult

Host and habitat: *Brycon hilarii* (FW)

Locality: São Paulo

References: Machado Filho (1959c), Golvan (1969), Thatcher (1991, 2006)

Echinorhynchus gomesi Machado-Filho, 1948—adult

Host and habitat: *Prochilodus nigricans* (FW)

Locality: Mato Grosso

References: Machado Filho (1948)

Echinorhynchus gracilis Machado Filho, 1948—adult

Host and habitat: *Brycon hilarii* (FW)

Locality: São Paulo

References: Machado Filho (1948)

Echinorhynchus jucundus Travassos, 1923—adult

Hosts and habitat: *Piaractus brachypomus* (syn. *Colossoma bidens*) (FW), *Piaractus mesopotamicus* (FW)

Locality: São João, Mato Grosso

References: Travassos (1923), Machado Filho (1948), Ferraz de Lima *et al.* (1990), Thatcher (1991, 2006)

Echinorhynchus paranensis Machado-Filho, 1959—adult

Host and habitat: *Triportheus paranensis* (FW)

Locality: Mato Grosso

References: Machado Filho (1959c), Thatcher (1991)

Echinorhynchus salobrensis Machado Filho, 1948—adult

Host and habitat: *Mylossoma duriventre* (syn. *M. paraguayensis*) (FW)

Locality: Salobra, Mato Grosso

References: Machado Filho (1948), Thatcher (1991)

Echinorhynchus sp.—adult

Hosts and habitat: *Brycon cephalus* (FW), *Schizodon borellii* (FW)

Locality: Amazon River Basin, Upper Parana River/Paraná

References: Machado *et al.* (1994, 1995, 1996), Andrade *et al.* (2001), Pavanelli *et al.* (2004)

Echinorhynchidae gen. sp.—adult

Host and habitat: *Kyphosus* sp. (MAR)

Locality: Off Rio de Janeiro

References: Gomes *et al.* (1974)

Family Illiosentidae Golvan, 1960

Dollfusentis chandleri Golvan, 1969—adult

Hosts and habitat: *Archosargus rhomboidalis* (MAR), *Eucinostomus argenteus* (MAR), *Haemulon sciurus* (MAR), *Haemulon steindachneri* (MAR), *Micropogonias furnieri* (MAR), *Orthopristis ruber* (MAR), *Umbrina coroides* (MAR)

Locality: Off Rio de Janeiro

References: Kohn and Macedo (1984), Noronha *et al.* (1986), Vicente *et al.* (1989), Luque *et al.* (1996a, b), Alves and Luque (1999, 2000, 2001a, b)

Family Rhadinorhynchidae Travassos, 1923

Gorgorhynchus trachinotus Noronha, Vicente, Pinto & Fábio, 1986—adult

Host and habitat: *Trachinotus goodei* (MAR)

Locality: Off Rio de Janeiro

Reference: Noronha *et al.* (1986)

Gorgorhynchus sp.—adult and larva

Hosts and habitat: *Dactylopterus volitans* (MAR—adult), *Dipturus trachyderma* (MAR—larva), *Pinguipes brasilianus* (MAR—adult) new record, *Pseudopercis numida* (MAR—adult), *Sphyrna zygaena* (MAR—larva), *Squatina* sp. (MAR—larva)

Localities: Off Rio de Janeiro, off Rio Grande do Sul, off Paraná, off Santa Catarina

References: Knoff *et al.* (2001), Cordeiro and Luque (2005), Luque *et al.* (2008)

Rhadinorhynchus plagioscionis Thatcher, 1980—adult

Host and habitat: *Plagioscion squamosissimus* (FW)

Locality: Amazon River basin

Reference: Thatcher (1980, 1991)

Rhadinorhynchus pristis (Rudolphi, 1802)—adult

Hosts and habitat: *Coryphaena hippurus* (MAR), *Balistes vetula* (MAR), *Euthynnus alletteratus* (MAR), *Katsuwonus pelamis* (MAR), *Auxis thazard* (MAR), *Scomber japonicus* (MAR)

Locality: Off Rio de Janeiro

References: Rudolphi (1819), Abdallah *et al.* (2002), Mogrovejo and Santos (2002), Alves *et al.* (2003, 2005), Alves and Luque (2006), Oliva *et al.* (2008)

Rhadinorhynchus sp.—adult

Hosts and habitat: *Dactylopterus volitans* (MAR), *Merluccius hubbsi* (MAR) (new record),

Paralonchurus brasiliensis (MAR)

Locality: Off Rio de Janeiro

References: Ribeiro *et al.* (2002), Luque *et al.* (2003), Cordeiro and Luque (2005)

Serrasentis sp.—larva

Hosts and habitat: *Balistes capriscus* (MAR), *Haemulon steindachneri* (MAR), *Oligoplites palometa* (MAR), *Orthopristis ruber* (MAR), *Paralonchurus brasiliensis* (MAR), *Parona signata* (new record) (MAR)

Locality: Off Rio de Janeiro

References: Luque *et al.* (1995, 1996a, b, 2003), Takemoto *et al.* (1996), Luque and Poulin (2004), Alves *et al.* (2005)

Order Polymorphida Petrochenko, 1956

Family Polymorphidae Meyer, 1931

Bolbosoma sp.—larva

Host and habitat: *Scomber japonicus* (MAR), *Merluccius hubbsi* (new host record) (MAR)

Locality: Off Rio de Janeiro

Reference: Rêgo and Santos (1983)

Corynosoma australe Johnston, 1937—larva

Hosts and habitat: *Centropomus undecimalis* (MAR), *Cephalopholis fulva* (MAR), *Cynoscion guatucupa* (MAR), *Diapterus rhombeus* (MAR), *Galeorhinus galeus* (MAR), *Genypterus brasiliensis* (MAR), *Hexanchus griseus* (MAR), *Menticirrhus americanus* (MAR), *Micropogonias furnieri* (MAR), *Mullus argentinae* (MAR), *Paralichthys isosceles* (MAR), *Pomatomus saltatrix* (MAR), *Prionotus punctatus* (MAR), *Scomber japonicus* (MAR), *Squalus megalops* (MAR), *Squatina* sp. (MAR)

Localities: Off Rio de Janeiro, off Rio Grande do Sul, off Paraná

References: Pereira and Neves (1993), Luque and Chaves (1999), Alves and Luque (1999, 2000, 2001a, b), Knoff *et al.* (2001), Abdallah *et al.* (2002), Luque *et al.* (2002), Alves *et al.* (2002a, b, 2003), Sabas and Luque (2003), Tavares and Luque (2004b), Luque and Poulin (2004), Timi *et al.* (2005), Bicudo *et al.* (2005), Oliva *et al.* (2008)

Corynosoma sp.—larva

Hosts and habitat: *Euthynnus alletteratus* (MAR), *Galeorhinus galeus* (MAR), *Hexanchus griseus* (MAR), *Merluccius hubbsi* (MAR—new record), *Micropogonias furnieri* (MAR), *Pagrus pagrus* (MAR), *Pomatomus saltatrix* (MAR), *Sarda sarda* (MAR), *Scomber japonicus* (MAR), *Squalus megalops* (MAR), *Squatina* sp. (MAR), *Umbrina canosai* (MAR)

Localities: Off Rio de Janeiro, off Rio Grande do Sul, off Paraná, off Santa Catarina

References: Rêgo *et al.* (1983), Cezar and Amato (1998), Luque and Chaves (1999), Alves and Luque (2000, 2001a, b, 2006), Knoff *et al.* (2001), Paraguassú *et al.* (2002), Luque and Poulin (2004), Oliva *et al.* (2008)

Hexaglandula mutabilis (Rudolphi, 1819) (syn. *Polymorphus mutabilis*)—larva

Hosts and habitat: *Atherina* sp. (BW/MAR), *Eucinostomus harengulus* (BW/MAR), *Sphoeroides testudineus* (BW/MAR), *Strongylura marinus* (BW/MAR)

Locality: Angra dos Reis, Rio de Janeiro

References: Travassos (1926)

Polymorphus sp.—larva

Hosts and habitats: *Anchoa tricolor* (MAR), *Astronotus ocellatus* (FW), *Genidens barbatus* (MAR), *Genypterus brasiliensis* (MAR), *Geophagus brasiliensis* (FW), *Oligosarcus hepsetus* (FW), *Pagrus pagrus* (MAR), *Priacanthus arenatus* (MAR), *Trichiurus lepturus* (MAR), *Urophycis mystacea* (MAR)

Localities: Off Rio de Janeiro, Rio Guandú – Rio de Janeiro

References: Silva *et al.* (2000a, b), Tavares *et al.* (2001), Alves *et al.* (2002a, b, c), Paraguassú *et al.* (2002), Luque and Poulin (2004), Abdallah *et al.* (2004), Tavares and Luque (2004a), Tavares *et al.* (2004a, 2005), Azevedo *et al.* (2006, 2007)

Polymorphidae gen. sp.—larva

Host and habitat: *Lophius gastrophysus* (new record) (MAR)

Locality: Off Rio de Janeiro

Class Polyacanthocephala Amin, 1987

Order Polyacanthorhynchida Amin, 1987

Family Polyacanthorhynchidae Golvan, 1956

Polyacanthorhynchus macrorhynchus (Diesing, 1856)—adult

Host and habitat: *Arapaima gigas* (FW)

Locality: Amazon River basin

References: Diesing (1856), Travassos (1919), Travassos *et al.* (1928), Machado Filho (1947), Golvan (1956), Travassos and Freitas (1964), Thatcher (1991, 2006)

Polyacanthorhynchus rhopalorhynchus (Diesing, 1851)—adult

Host and habitat: *Arapaima gigas* (FW)

Localities: Amazon River basin, Mato Grosso

References: Diesing (1851), Baylis (1927), Travassos (1919), Travassos *et al.* (1928), Machado Filho (1947), Thatcher (1991, 2006)

Class Eoacanthocephala

Order Gyraacanthocephala Van Cleave, 1936

Family Quadrigyridae Van Cleave, 1920

Machadosentis travassosi Noronha, 1992—adult

Host and habitat: *Gymnothorax ocellatus* (MAR)

Locality: Off Bahia

Reference: Noronha (1992)

Palliolisentis quinqueungulis Machado-Filho, 1960—adult

Hosts and habitat: *Triportheus angulatus* (FW), *Triportheus paranensis* (FW)

Locality: Salobra, Mato Grosso

References: Machado Filho (1960), Thatcher (1991)

Quadrigyrus brasiliensis Machado Filho, 1941—adult

Hosts and habitat: *Hoplerythrinus unitaeniatus* (FW), *Hoplias malabaricus* (FW).

Locality: Salobra, Mato Grosso, Upper Parana River/Paraná

References: Machado Filho (1941), Thatcher (1991), Pavanelli *et al.* (2004)

Quadrigyrus machadoi Fabio, 1983—larva and adult

Hosts and habitat: *Cichla monoculus* (FW—larva), *Hemisorubim platyrhynchos* (FW—larva), *Gymnotus* sp. (FW—adult), *Hoplias malabaricus* (FW—adult)

Localities: Parana River/Paraná, São Paulo, Rio de Janeiro, Rio Baía, Mato Grosso do Sul

References: Fabio (1983), Weiblen and Brandão (1992), Pavanelli *et al.* (2001, 2002, 2004), Machado *et al.* (2000), Guidelli *et al.* (2003), Isaac *et al.* (2004), Rosim *et al.* (2005)

Quadrigyrus torquatus Van Cleave, 1920—adult

Hosts and habitat: *Acestrorhynchus lacustris* (FW), *Hoplias malabaricus* (FW), *Leporinus lacustris* (FW)

Localities: Upper Parana River/Paraná, Rio de Janeiro

References: Fabio (1983), Thatcher (1991) Pavanelli *et al.* (2004), Carvalho *et al.* (2003), Guidelli *et al.* (2006)

Quadrigyrus sp.—adult

Hosts and habitat: *Astyanax altiparanae* (FW), *Iheringichthys labrosus* (FW), *Pachyurus squamipennis* (FW), *Prochilodus lineatus* (FW)

Localities: Upper Parana River/Paraná São Francisco River, Mato Grosso, Paraná

References: Pavanelli *et al.* (2004), Lizama *et al.* (2005), Moreira *et al.* (2005), Takemoto *et al.* (2005)

Order Neoechinorhynchida Southwell & MacFie, 1925

Family Neoechinorhynchidae Ward, 1917

Floridosentis mugilis (Machado Filho, 1951) (syn. *Atactorhynchus mugils* Machado Filho, 1951)—adult

Host and habitat: *Mugil platanus* (MAR)

Locality: Off Rio de Janeiro

References: Knoff *et al.* (1997)

Gracilisentis variabilis (Diesing, 1851) (syns *Echinorhynchus variabilis*, *Octospinifer variabilis*)

Hosts and habitat: *Achirus achirus* (FW), *Achirus lineatus* (FW), *Achirus* sp. (FW), *Glyptoperichthys lituratus* (FW), *Hoplias malabaricus* (FW), *Hypostomus auroguttatus* (FW), *Hypostomus nematopterus* (FW), *Hypostomus plecostomus* (FW), *Prochilodus lineatus* (FW), *Pleuronectes* sp. (FW)

Localities: Pirassununga, São Paulo, Amazon River Basin

References: Diesing (1851, 1856), Travassos *et al.* (1928), Travassos & Kohn (1965), Kritscher (1976), Thatcher (1991, 2006)

Gorytocephalus spectabilis (Machado Filho, 1959) (syn. *Neoechinorhynchus spectabilis* Machado Filho, 1959)—adult

Hosts and habitat: *Cyphocharax gilbert* (FW), *Steindachnerina elegans* (FW)

Locality: Emas, Pirassununga, São Paulo

References: Machado Filho (1959a), Travassos and Kohn (1965), Kohn and Fernandes (1987), Thatcher (1991, 2006)

Gorytocephalus elongorchis Thatcher, 1979—adult

Host and habitat: *Hypostomus carinatus* (FW)

Locality: Amazon River Basin

References: Thatcher (1979, 1991, 2006)

Neoechinorhynchus (Neoechinorhynchus) buttnerae Golvan, 1956—adult

Host and habitat: *Colossoma macropomum* (FW)

Locality: Amazon River Basin

References: Golvan (1956), Thatcher (1991), Ferraz de Lima *et al.* (1990), Malta *et al.* (2001), Fischer *et al.* (2003)

Neoechinorhynchus (Neoechinorhynchus) curemai Noronha, 1973—adult

Hosts and habitats: *Mugil curema* (BW), *Prochilodus lineatus* (FW)

Localities: River Amazon, Pirassununga—São Paulo, Volta Grande reservoir, Minas Gerais, Mato Grosso, Upper Parana River, Potengi River—Rio Grande do Norte

References: Noronha (1973, 1984), Kohn *et al.* (1985), Kohn and Fernandes (1987), Brasil-Sato and Pavanelli (1999), Ranzani-Paiva *et al.* (2000), Martins *et al.* (2000, 2001), Fortes *et al.* (2000), Santos *et al.* (2003, 2005), Pavanelli *et al.* (2004), Lizama *et al.* (2005, 2006)

Neoechinorhynchus (Neoechinorhynchus) macronucleatus Machado Filho, 1954—adult

Hosts and habitat: *Hoplias malabaricus* (FW), *Lycengraulis* sp. (FW)

Localities: Juparanã lagoon, Espírito Santo, Campos, Rio de Janeiro

References: Machado Filho (1954), Fabio (1983)

Neoechinorhynchus (Neoechinorhynchus) paraguayensis Machado Filho, 1959—adult

Hosts and habitat: *Cichlasoma monoculus* (FW), *Geophagus brasiliensis* (FW), *Hoplias malabaricus* (FW)

Locality: Guandu-Açú River—Rio de Janeiro

References: Machado Filho (1959b), Nickol and Padilha (1979), Azevedo *et al.* (2006), Thatcher (1991, 2006)

Neoechinorhynchus (Neoechinorhynchus) pimelodi Brasil-Sato & Pavanelli, 1998—adult

Hosts and habitat: *Franciscodoras marmoratus* (FW), *Pimelodus maculatus* (FW)

Locality: São Francisco River, Três Marias—Mato Grosso

References: Brasil-Sato and Pavanelli (1998, 1999), Brasil-Sato (2003), Santos and Brasil-Sato (2004)

Neoechinorhynchus (Neoechinorhynchus) pterodoridis Thatcher, 1981

Host and habitat: *Pterodoras granulosus* (FW)

Locality: Amazon River Basin

References: Thatcher (1981, 1991)

Neoechinorhynchus sp.—larva and adult

Hosts and habitat: *Conorynchus conirostris* (FW—larval), *Corydoras julii* (FW—adult), *Pseudoplatystoma fasciatum* (FW)

Locality: Aquidauana River, River São Francisco, aquarium in Germany

References: Moravec *et al.* (1999), Brasil-Sato and Santos (2005), Campos *et al.* (2008)

Octospiniferoides incognita Schmidt & Huggins, 1973—adult

Host and habitat: *Leporinus lacustris* (FW), *Schizodon borellii* (FW), *Schizodon fasciatus* (FW)

Locality: Upper Parana River/Paraná, Rondonia State

References: Machado *et al.* (1994, 1996), Thatcher (1998), Pavanelli *et al.* (2004), Guidelli *et al.* (2006)

Acanthocephala fam. gen. sp. (unidentified specimens)—larva and adult

Hosts and habitats: *Ageneiosus ucayalensis* (FW), *Brycon hilarii* (FW), *Cichlasoma paranaense* (FW), *Chloroscombrus chrysurus* (MAR), *Cichlasoma paranaense* (FW), *Cynoscion* sp. (MAR), *Hemicaranx amblyrhynchus* (MAR), *Hoplerythrinus unitaeniatus* (FW), *Hoplias malabaricus* (FW), *Leporinus lacustris* (FW), *Menticirrus americanus* (MAR), *Mugil curema* (MAR), *Mugil platanus* (MAR), *Paralonchurus brasiliensis* (MAR), *Piaractus mesopotamicus* (FW), *Pimelodus maculatus* (FW), *Pseudoplatystoma corruscans* (FW), *Pterodoras granulosus* (FW), *Pygocentrus nattereri*

(FW), *Rachycentron canadum* (MAR), *Rhaphiodon vulpinus* (FW), *Schizodon altoparanae* (FW), *Schizodon nasutus* (FW), *Serrasalmus marginatus* (FW), *Serrasalmus spilopleura* (FW)

Localities: Rivers Aquidauana, Miranda, Paraguay—Mato Grosso do Sul, Cuiabá and Manso Rivers—Mato Grosso, Upper Paraná river-Paraná, off São Paulo, off Espírito Santo, Guandú River – Rio de Janeiro and off Marambaia Island – Rio de Janeiro

References: Travassos and Freitas (1940), Travassos *et al.* (1963, 1964), Kohn and Fernandes (1987), Pavanelli *et al.* (2004), Adriano *et al.* (2005), Santos *et al.* (2007).

Host-parasite list

Hosts	Parasite species
Class Actinopterygii (ray-finned fishes)	
Order Anguilliformes	
Family Muraenidae	
<i>Gymnothorax ocellatus</i> Agassiz	<i>Machadosentis travassosi</i>
Order Atheriniformes	
Family Atherinopsidae	
<i>Atherina</i> sp.	<i>Hexaglandula mutabilis</i>
Order Cyprinodontiformes	
Family Anablepidae	
<i>Anableps microlepis</i> Müller & Troschel	<i>Amapacanthus amazonicus</i>
Order Beloniformes	
Family Belonidae	
<i>Strongylura marina</i> (Walbaum)	<i>Hexaglandula mutabilis</i>
Order Clupeiformes	
Family Engraulidae	
<i>Anchoa tricolour</i> (Spix & Agassiz)	<i>Polymorphus</i> sp.
<i>Lycengraulis</i> sp.	<i>Neoechinorhynchus macronucleatus</i>
Order Characiformes	
Family Acestrorhynchidae	
<i>Acestrorhynchus lacustris</i> (Lütken)	<i>Quadrigyrus torquatus</i>
Family Anostomidae	
<i>Leporinus lacustris</i> Amaral Campos	<i>Octospiniferoides incognita</i> <i>Quadrigyrus torquatus</i> Acanthocephala fam. gen. sp.
<i>Schizodon altoparanae</i> Garavello & Britski	Acanthocephala fam. gen. sp.
<i>Schizodon borellii</i> (Boulenger)	<i>Echinorhynchus</i> sp. <i>Octospiniferoides incognita</i>
<i>Schizodon fasciatus</i> Spix & Agassiz	<i>Octospiniferoides incognita</i>
<i>Schizodon nasutus</i> Kner	Acanthocephala fam. gen. sp.
Family Characidae	
<i>Astyanax altiparanae</i> Garutti & Britski	<i>Quadrigyrus</i> sp.
<i>Brycon cephalus</i> (Günther)	<i>Echinorhynchus</i> sp.
<i>Brycon hildebrandi</i> (Valenciennes)	<i>Echinorhynchus briconi</i> <i>Echinorhynchus gracilis</i>

<i>Colossoma macropomum</i> (Cuvier)	Acanthocephala fam. gen. sp.
<i>Mylossoma duriventre</i> (Cuvier)	<i>Neoechinorhynchus buttnerae</i>
<i>Oligosarcus hepsetus</i> (Cuvier)	<i>Echinorhynchus salobrensis</i>
<i>Piaractus brachypomus</i> (Cuvier)	<i>Polymorphus</i> sp.
<i>Piaractus mesopotamicus</i> (Holmberg)	<i>Echinorhynchus jucundus</i>
	<i>Echinorhynchus jucundus</i>
<i>Pygocentrus nattereri</i> Kner	Acanthocephala fam.gen. sp.
<i>Serrasalmus marginatus</i> Valenciennes	Acanthocephala fam. gen. sp.
<i>Serrasalmus spilopleura</i> Kner	Acanthocephala fam. gen. sp.
<i>Triportheus angulatus</i> (Spix & Agassiz)	<i>Palliolisentis quinqueungulis</i>
<i>Triportheus paranensis</i> (Günther)	<i>Echinorhynchus paranensis</i>
	<i>Palliolisentis quinqueungulis</i>
Family Cynodontidae	
<i>Rhaphiodon vulpinus</i> Spix & Agassiz	Acanthocephala fam. gen. sp.
Family Curimatidae	
<i>Cyphocharax gilbert</i> (Quoy & Gaimard)	<i>Gorytocephalus spectabilis</i>
<i>Steindachnerina elegans</i> (Steindachner)	<i>Gorytocephalus spectabilis</i>
Family Erythrinidae	
<i>Hoplerythrinus unitaeniatus</i> (Agassiz)	<i>Quadrigyrus brasiliensis</i>
	Acanthocephala fam. gen. sp.
<i>Hoplias malabaricus</i> (Bloch)	<i>Gracilisentis variabilis</i>
	<i>Quadrigyrus brasiliensis</i>
	<i>Quadrigyrus machadoi</i>
	<i>Quadrigyrus torquatus</i>
	<i>Neoechinorhynchus macronucleatus</i>
	<i>Neoechinorhynchus paraguayensis</i>
	Acanthocephala fam. gen. sp.
Family Prochilodontidae	
<i>Prochilodus lineatus</i> (Valenciennes)	<i>Gracilisentis variabilis</i>
	<i>Neoechinorhynchus curemai</i>
	<i>Quadrigyrus</i> sp.
<i>Prochilodus nigricans</i> Agassiz	<i>Echinorhynchus gomesi</i>
Order Gadiformes	
Family Merlucciidae	
<i>Merluccius hubbsi</i> Marini	<i>Bolbosoma</i> sp.
	<i>Corynosoma</i> sp.
	<i>Rhadinorhynchus</i> sp.
Family Phycidae	
<i>Urophycis mystacea</i> Ribeiro	<i>Polymorphus</i> sp.
Order Gymnotiformes	
Family Gymnotidae	
<i>Gymnotus</i> sp.	<i>Quadrigyrus machadoi</i>
Order Lophiiformes	
Family Lophiidae	
<i>Lophius gastrophysus</i> Ribeiro	Polymorphidae gen. sp.

Order Ophidiiformes

Family Ophidiidae

Genypterus brasiliensis Regan

Corynosoma australe
Polymorphus sp.

Order Perciformes

Family Carangidae

Chloroscombrus chrysurus (Linnaeus)

Acanthocephala fam. gen. sp.

Hemicaranx amblyrhynchus (Cuvier)

Acanthocephala fam. gen. sp.

Oligoplites palometa (Cuvier)

Serrasentis sp.

Parona signata (Jenyns)

Serrasentis sp.

Trachinotus goodie Jordan & Evermann

Gorgorhynchus trachinotus

Family Centropomidae

Centropomus undecimalis (Bloch)

Corynosoma australe

Family Cichlidae

Astronotus ocellatus (Agassiz)

Polymorphus sp.

Cichla monoculus Spix & Agassiz

Quadrigyrus machadoi

Neoechinorhynchus paraguayensis

Cichlasoma paranaense Kullander

Acanthocephala fam. gen. sp.

Geophagus brasiliensis (Quoy & Gaimard)

Neoechinorhynchus paraguayensis

Polymorphus sp.

Family Coryphaenidae

Coryphaena hippurus Linnaeus

Rhadinorhynchus pristin

Family Gerreidae

Diapterus rhombeus (Cuvier)

Corynosoma australe

Eucinostomus argenteus Baird & Girard

Dollfusentis chandleri

Eucinostomus harengulus Goode & Bean

Hexaglandula mutabilis

Family Haemulidae

Haemulon sciurus (Shaw)

Dollfusentis chandleri

Haemulon steindachneri (Jordan & Gilbert)

Dollfusentis chandleri

Serrasentis sp.

Orthopristis ruber (Cuvier)

Dollfusentis chandleri

Serrasentis sp.

Family Kyphosidae

Kyphosus sp.

Echinorhynchidae gen. sp.

Family Mugilidae

Mugil platanus Günther

Floridosentis mugilis

Acanthocephala fam. gen. sp.

Mugil curema Valenciennes

Neoechinorhynchus curemai

Acanthocephala fam. gen. sp.

Family Mugiloididae

Pinguipes brasilianus Cuvier

Gorgorhynchus sp.

Heterosentis sp.

Pseudopercis numida Ribeiro

Gorgorhynchus sp.

Heterosentis sp.

Family Mullidae

<i>Mullus argentinae</i> Hubbs & Marini	<i>Corynosoma australe</i>
Family Pomatomidae	
<i>Pomatomus saltatrix</i> (Linnaeus)	<i>Corynosoma australe</i> <i>Corynosoma</i> sp.
Family Priacanthidae	
<i>Priacanthus arenatus</i> Cuvier	<i>Polymorphus</i> sp.
Family Rachycentridae	
<i>Rachycentron canadum</i> (Linnaeus)	Acanthocephala fam. gen. sp.
Family Sciaenidae	
<i>Cynoscion guatucupa</i> (Cuvier)	<i>Corynosoma australe</i>
<i>Cynoscion</i> sp.	Acanthocephala fam. gen. sp.
<i>Menticirrhus americanus</i> (Linnaeus)	<i>Corynosoma australe</i> Acanthocephala fam. gen. sp.
<i>Micropogonias furnieri</i> (Desmarest)	<i>Corynosoma australe</i> <i>Corynosoma</i> sp. <i>Dollfusentis chandleri</i>
<i>Pachyurus squamipennis</i> Agassiz	<i>Quadrigyrus</i> sp.
<i>Paralonchurus brasiliensis</i> (Steindachner)	<i>Rhadinorhynchus</i> sp. <i>Serrasentis</i> sp. Acanthocephala fam. gen. sp.
<i>Plagioscion squamosissimus</i> (Heckel)	<i>Rhadinorhynchus plagioscionis</i>
<i>Umbrina canosai</i> Berg	<i>Corynosoma</i> sp.
<i>Umbrina coroides</i> (Cuvier)	<i>Dollfusentis chandleri</i>
Family Scombridae	
<i>Auxis thazard</i> (Lacepède)	<i>Rhadinorhynchus pristis</i>
<i>Euthynnus alletteratus</i> (Rafinesque)	<i>Corynosoma</i> sp. <i>Rhadinorhynchus pristis</i>
<i>Katsuwonus pelamis</i> (Linnaeus)	<i>Rhadinorhynchus pristis</i>
<i>Sarda sarda</i> (Bloch)	<i>Corynosoma</i> sp.
<i>Scomber colias</i> Gmelin	<i>Golvanorhynchus golvani</i>
<i>Scomber japonicus</i> Houttuyn	<i>Bolbosoma</i> sp. <i>Corynosoma australe</i> <i>Corynosoma</i> sp. <i>Golvanorhynchus golvani</i> <i>Rhadinorhynchus pristis</i>
Family Serranidae	
<i>Cephalopholis fulva</i> (Linnaeus)	<i>Corynosoma australe</i>
Family Sparidae	
<i>Archosargus rhomboidalis</i> (Linnaeus)	<i>Dollfusentis chandleri</i>
<i>Pagrus pagrus</i> (Linnaeus)	<i>Corynosoma</i> sp. <i>Polymorphus</i> sp.
Family Trichiuridae	
<i>Trichiurus lepturus</i> Linnaeus	<i>Polymorphus</i> sp.
Order Pleuronectiformes	
Family Achiridae	
<i>Achirus achirus</i> (Linnaeus)	<i>Gracilisentis variabilis</i>

<i>Achirus lineatus</i> (Linnaeus)	<i>Gracilisentis variabilis</i>
<i>Achirus</i> sp.	<i>Gracilisentis variabilis</i>
Family Paralichthyidae	
<i>Paralichthys isosceles</i> Jordan	<i>Corynosoma australe</i>
Family Pleuronectidae	
<i>Pleuronectes</i> sp.	<i>Gracilisentis variabilis</i>
Order Scorpaeniformes	
Family Dactylopteridae	
<i>Dactylopterus volitans</i> (Linnaeus)	<i>Gorgorhynchus</i> sp. <i>Rhadinorhynchus</i> sp.
Family Triglidae	
<i>Prionotus punctatus</i> (Bloch)	<i>Corynosoma australe</i>
Order Siluriformes	
Family Ariidae	
<i>Sciades passany</i> Valenciennes	<i>Amapacanthus amazonicus</i>
<i>Genidens barbatus</i> (Lacepède)	<i>Polymorphus</i> sp.
Family Auchenipteridae	
<i>Ageneiosus ucayalensis</i> Castelnau	Acanthocephala fam. gen. sp.
Family Callichthyidae	
<i>Corydoras julii</i> Steindachner	<i>Neoechinorhynchus</i> sp.
Family Doradidae	
<i>Franciscodoras marmoratus</i> (Reinhardt)	<i>Neoechinorhynchus pimelodi</i>
<i>Oxydoras kneri</i> Bleeker	<i>Paracavisoma impudica</i>
<i>Oxydoras niger</i> (Valenciennes)	<i>Paracavisoma impudica</i>
<i>Pterodoras granulatus</i> (valenciennes)	Acanthocephala fam. gen. sp. <i>Neoechinorhynchus pterodoridis</i>
Family Loricariidae	
<i>Glyptoperichthys lituratus</i> (Kner)	<i>Gracilisentis variabilis</i>
<i>Hypostomus auroguttatus</i> Kner	<i>Gracilisentis variabilis</i>
<i>Hypostomus carinatus</i> (Steindachner)	<i>Gorytocephalus elongorchis</i>
<i>Hypostomus nematopterus</i> Isbrücker & Nijssen	<i>Gracilisentis variabilis</i>
<i>Hypostomus plecostomus</i> (Linnaeus)	<i>Gracilisentis variabilis</i>
Family Pimelodidae	
<i>Hemisorubim platyrhynchus</i> (Valenciennes)	<i>Quadrigyrus machadoi</i>
<i>Iheringichthys labrosus</i> (Lütken)	<i>Quadrigyrus</i> sp.
<i>Pimelodus maculatus</i> (Lacepède)	Acanthocephala fam. gen. sp. <i>Neoechinorhynchus pimelodi</i>
<i>Pseudoplatystoma corruscans</i> (Spix & Agassiz)	Acanthocephala fam. gen. sp.
<i>Pseudoplatystoma fasciatum</i> (Linnaeus, 1766)	<i>Neoechinorhynchus</i> sp.
Order Siluriformes (species incertae sedis)	
<i>Conorynchus conirostris</i> (Valenciennes)	<i>Neoechinorhynchus</i> sp.
Order Osteoglossiformes	
Family Arapaimatidae	
<i>Arapaima gigas</i> (Schinz)	<i>Polyacanthorhynchus macrorhynchus</i> <i>Polyacanthorhynchus rhopalorhynchus</i>

Order Tetraodontiformes

Family Balistidae

Balistes capriscus Gmelin

Serrasentis sp.

Balistes vetula Linnaeus

Rhadinorhynchus pristis

Family Tetraodontidae

Sphoeroides greeleyi Gilbert

Brasacanthus sphoeroides

Sphoeroides testudineus (Linnaeus)

Hexaglandula mutabilis

Class Chondrichthyes (cartilaginous fishes)

Order Carcharhiniformes

Family Sphyrnidae

Sphyrna zygaena (Linnaeus)

Gorgorhynchus sp.

Family Triakidae

Galeorhinus galeus (Linnaeus)

Corynosoma australe

Corynosoma sp.

Order Hexanchiformes

Family Hexanchidae

Hexanchus griseus (Bonnaterre)

Corynosoma australe

Corynosoma sp.

Order Rajiformes

Family Rajidae

Dipturus trachyderma Krefft & Stehmann

Gorgorhynchus sp.

Order Squaliformes

Family Squalidae

Squalus megalops (Macleay)

Corynosoma australe

Corynosoma sp.

Order Squatiniformes

Family Squatinidae

Squatina sp.

Corynosoma australe

Corynosoma sp.

Gorgorhynchus sp.

Discussion

Acanthocephalan parasites of fishes come in two forms, adults from the intestine and larvae (post-cystacanths) from the tissues. The latter are usually members of the family Polymorphidae and utilise fishes (mainly marine) as a second intermediate host in the life-cycle. Brazilian records belong to species of *Corynosoma*, *Bolbosoma*, *Hexaglandula* and *Polymorphus*, the adults of which are found in aquatic mammals and birds. The majority of Brazilian records from fishes are of adult specimens, although ingested cystacanths and juvenile worms are also found in the intestine. All acanthocephalans utilise arthropods as intermediate hosts; in the case of species from fishes these are normally crustaceans. The host-specificity of the worms to their fish hosts varies considerably; in some cases they are found in a single host and in others in a group of unrelated hosts, which perhaps reflects the host's diet.

The phylum Acanthocephala is a relatively poorly known helminth group in Neotropical fishes. According to Luque & Poulin (2007), they represent fewer than 5% of the host-parasites associations recorded in

freshwater and marine fishes from this region. This checklist shows that from 123 fish hosts species reported, 116 are ray-finned fishes and seven are cartilaginous, and the most parasitized fish family is the Characidae with 15 acanthocephalan species, followed by the Sciaenidae with nine.

The composition of the known acanthocephalan fauna shows that the Neoechinorhynchidae is the most represented family, comprising some 12 named species parasitic in freshwater, brackish water and marine fishes. Some genera are clearly specific to South American fishes, whereas others are cosmopolitan. The host with greatest number of reported acanthocephalan species is the marine fish *Haemulon sciurus*, and the acanthocephalan recorded from the greatest number of hosts is *Corynosoma australe*, a larval form.

Some apparent Brazilian records are not included in the lists above. Although previously listed (Thatcher, 1991, 2006) as occurring in the region, *Palliolisentis ornatus* Machado-Filho, 1960, from *Triporthus paranensis* (FW), was originally described from the Paraguay River, Paraguay. We can find no definite Brazilian record. Similarly, *Megapriapus ungriai* (Gracia-Rodrigo, 1960) from *Potamotrygon hystrix*, and *Quadrigyrus torquatus* Van Cleave, 1920 from *Astyanax bimaculatus* (FW), *Crenicichla geayi* (FW), *Gephyrocharax valencia* (FW) and *Symbranchus marmoratus* (FW), have apparently been reported only from Venezuela and are consequently omitted from our list.

Acknowledgements

The authors are very grateful to the Fundação Carlos Chagas Filho de Amparo à Pesquisa do Estado do Rio de Janeiro (FAPERJ) and the Instituto Oswaldo Cruz for financial support. José L. Luque was supported by a research fellowship from Conselho Nacional de Desenvolvimento Científico e Tecnológico do Brasil (CNPq). Luiz E. R. Tavares was supported by a Junior Posdoctoral Fellowship from CNPq.

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