Monogenean infestations of arowana (*Osteoglossum bicirrhosum*) and cat fish (*Hypostomus plecostomus*)

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Received: May 2015 Accepted: June 2015

Abstract

Arowana (*Osteoglossum bicirrhosum*) and cat fish (*Hypostomus plecostomus*) are two species of ornamental fishes which are mostly imported to Iran. Monogenea are plathyhelminthes which can dominantly infest the fish skin and gills with high host specificity. In this research, 35 *O. bicirrhosum* and 50 *H. plecostomus* with clinical signs were collected from different ornamental fish markets in Semnan, Iran and transferred alive to the Lab. Fish skin and gills were examined for monogenean infestations. No monogenea was observed on the skin specimens, but *Gonocleithrum cursitans* and *Unilatus unilatus* infested 54.28% and 74% of gills in *O. bicirrhosum* and *H. plecostomus*, respectively. This is the first report of both *G.cursitans* and *U. unilatus* in Iran.

Keywords: Arowana, *Osteoglossum bicirrhosum*, Cat fish, *Hypostomus plecostomus*, Monogenea, Iran

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[DOR: 20.1001.1.15622916.2016.15.2.1.7]

Introduction

The Arowana (*O. bicirrhosum*) (order: Osteoglossiform, family: Osteoglossidae) is an ornamental fish which has an elongated body covered with large, heavy scales. There is a toothed bone on the floor of its mouth, and the "tongue", is equipped with barbes (Lemos *et al*., 2012).Therefore, arowana has various diets such as insects, arachnids, small fishes, crustaceans and mollusks (Tavares-Dias *et al*., 2014). Arowana is one of the most popular ornamental fish in Iran.

Cat fish (order Siluriformes, family Loricariidae) consist of more than 2800 species with worldwide distribution (Mendoza-Palmero *et al*., 2015). *H. plecostomus* is one of the most species which is imported to Iran. Cat fishes, especially large pimelodids and doradids, are greatly appreciated by aquarists. They are used for local consumption in aquariums (Mendoza-Palmero *et al*., 2015).

Monogenea are flatworms or Platyhelminthes (Class Monogenoidea). They have a direct life cycle and can parasitize cephalopods, amphibians, reptiles and mammals. Most of them are fish ectoparasites with relatively high host specificity (Buchmann and Bresciani, 2006). Although, most monogenea are on the skin, fins, gills, mouth cavity and nostrils of the infested fish, few species are adopted for endoparasitic life and can infect the bladder, urinary ducts, digestive tract and even the cloaca (Buchmann and Bresciani, 2006).

Monogenea are hermaphrodic worms. Most of them are oviparous. The worms produce and release eggs into the aquatic habitat. Eggs hatch by releasing ciliated or non-ciliated larva, following a free-swimming larval phase. The larva attach to the host and develop into post larval and adult stages (Cone and Burt, 1981; Buchmann and Bresciani, 2006). Some other monogenea are ovivivіparous or viviparous (Buchmann and Bresciani, 2006).

Some of the important monogenean organs which are mostly used in identification keys are anterior bar, posterior bar, anterior anchors, posterior anchors, hooks and some male or female copulatory organs (Boeger and Vianna, 2006). Nowadays, molecular tests are also used for monogenean nomenclature.

The aim of this study was to understand the monogenean infestation rates of arowana (*O.bicirrhosum*) and cat fish (*H.plecostomus*) and to identify the monogenea which infest these imported ornamental fishes in Iran.

Materials and methods

35 Arowana (*O.bicirrhosum*) and 50 cat fish (*H.plecostomus*) with the clinical signs were selected and collected from ornamental fish markets in Semnan during 2011 to 2015. Fishes (samples) were transferred alive to the laboratory. They were euthanized and wet smears were obtained from their skin and observed under light microscopy. Gills of the fishes were separated and placed in petri dishes and observed under a

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stereomicroscope. Helminthes were removed from the gills and put on microscopic slides. Malmberg solution which consisted of ammonium picrate was added to the positive smears and covered with a cover glass. The monogenean genera were identified according to Boeger and Vianna (2006).

Results

No monogenea was observed on the *O.bicirrhosum* and *H.plecostomus* skin. 19 out of 35 (54.28%) *O.bicirrhossum* gills were infested by *G. cursitans* (Dactylogyridae, Ancyrocephalinae) (Fig.1). 37 out of 50 (74%) *H.plecostomus* gills were infested by *U. unilatus* (Dactylogyridae, Ancyrocephalinae) (Fig.2).

Both *Gonocleithrum* and *Unilatus* have a single anterior bar. In *Gonocleithrum* identification; male copulatory organ (MCO), posterior bar and gonadal bar are important, in *Unilatus* identification; anterior and posterior bar, posterior anchor, MCO, accessory piece and hooks are important. Identifying morphometric measurements of both are presented in Tables 1 and 2. *G. cursitans and U. unilatus* were well described by Kritsky and Tatcher (1983) and Mizelle *et al*. (1968), respectively.

Discussion

Different monogen species were reported from various ornamental fish in Iran. For the first time Ebrahimzadeh Mousavi (2003) examined ornamental fish parasites and reported *Dactylogyrus vastator* from catfish. Shoaibi reported *Trichodina sp.*, *Ichthyophthyrius multifiliis* and also a species of Ancyrocephalus and Gyrodactylus from the gills of imported catfish (Shoaibi, 2009).

Different species of *Gonocleithrum* have been reported. Kritsky and Tatcher (1983) described *Gonocleithrum* as a new genus and five new species; *G. planacrus*, *G. aruanae*, *G. coenoideum*, *G. cursitans* and *G. planacroideum* on *O. bicirrhosum* gills in Brazil.

In other similar studies, 100% and 87.5% of examined *O.bicirrhosum* gills were infested by *G. aruanae* in Brazil (Lemos *et al*., 2012; Tavares-Dias *et al*., 2014).

In this research, the monogenean infestation rate of *O. bicirrhossum* was relatively high (82.8%) in Iran, the same as previous studies in Brazil, but all the removed monogenea were *G.cursitans*. The identified *G. cursitans* were similar to what Kritsky and Tatcher (1983) described; anterior bar had enlarged ends and median anterior process, posterior bar was broadly v-shaped, gonadal bar was Y-shaped with inconspicuous flanges on anterior arms, the MCO was coiled.

Unilatus and *U.unilatus* was proposed by Mizelle and Kritsky (1967) on *Plecostomus* gills. In 1968 *U.brittani* was reported on *Plecostomus* gills (Mizelle *et al*., 1968) and *U.anoculus* on *Hypostomus bolivianus* gills (Price, 1968). In 1974, *U. unilatus* was identified on *Hypostomus robinii* gills (Molnar *et al*., 1974).

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Table1: Morphometric measurements of *Unilatus unilatus.*

***Unilatus unilatus* measurement**	**Micrometer (n=10)**
Body length	560(487-632)
Body width	135(127-149)
Anterior anchor length	35(30-39)
Anterior anchor base width	18(17-19)
Anterior bar length	32(29-36)
Posterior anchor length	22(20-24)
Posterior anchor base width	16(14-18)
Posterior bar length	42(35-49)
Hook length	12(10-14)
Cirrus length	61(59-63)
Accessory piece length	42 (37 – 46)

Table2: Morphometric measurements of *Gonocleithrum cursitans.*

***Gonocleithrum cursitans* measurement**	**Micrometer (n=6)**
Body length	371(360-381)
Body width	69(65-73)
Dorsal anchor length	34(31-37)
Dorsal anchor base width	14(11-17)
Dorsal bar length	40(38-42)
Ventral anchor length	42(40-44)
Ventral anchor base width	21(19-23)
Ventral bar length	40(32-47)
Hook length	29(26-32)



Figure 1: *Gonocleithrum cursitans;* a: copulatory complex, b: gonadal bar, c: hook, d:Ventral anchor, e: Ventral bar, f: Dorsal anchor, g: Dorsal bar.400X.

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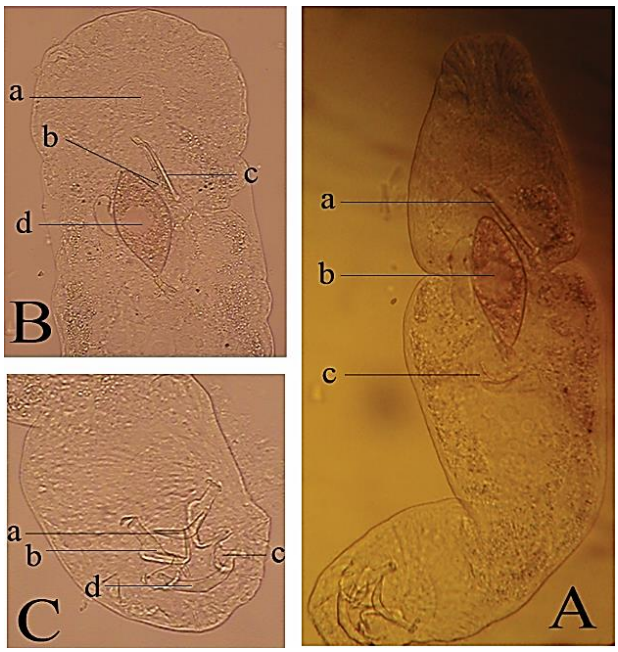


Figure 2: *Unilatus unilatus*; Aa: male copulatory organ and accessory piece, Ab: egg, Ac: egg filament, Ba: anterior sucker, Bb: male copulatory organ, Bc: accessory piece, Bd: egg, Ca: anterior bar, Cb: anterior anchor, Cc: posterior anchor, Cd: posterior bar. A 400X, B and C 400X.

Suriano reported *U. unilatus* on *Hypostomus* sp., *U. scaphirhychae* on *Dekeyseria scaphirhyncha* and *U. dissimilis* on *Hemiancistrus* sp., all of the reported species were removed from the gills of their hosts (Suriano, 1985). In 2012, *U. unilatus*was observed on *Hypostomus iheringii* and *Hypostomus strigaticeps* gills (Zica *et al*., 2012) and *U. unilatus*, *U. brittani* on *Pterygoplichthys anisitsi* in Peru (Mendoza-Palmero *et al*., 2012). A new species of *Unilatus*, named *U. irae*, was described in 2014 and was removed from armed cat fish (*Leporacanthicus galaxias*) gills and the infestation rate was 62.5% (Branches and Domingues, 2014).

In this research the monogenean infestation rate of *H. plecostomus* was 74% and all the identified monogenea were *U. unilatus*. According to the results, all *U. unilatus* specimens were more similar to what Mizelle *et al.* (1968) explained than the *U. unilatus* which was observed by Zica *et al*. (2012); the accessory piece was straight and anteriorly bowed as a hook. Both the anterior and posterior bar ends were slightly curved and tapered in the anterior end. A mid-portion projection was found posteriorly in the anterior and posterior bar.

In Iran, Both *G. cursitans* and *U. unilatus* were recorded for the first time on *O.*

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bicirrhossum and *H. plecostomus*, respectively.

The monogenean pathogenicity is closely related to the fish population, parasite number, Monogenean attachment organs and its physiology, gland secretions and feeding strategy (Boeger and Vianna, 2006; Buchmann and Bresciani, 2006). In crowded condition monogenea can rapidly become a problem and can easily transmit from one host to another by direct transmission. Large numbers of the parasite can produce extensive damage to the gills. Some abnormalities which can be observed in monogenean infested gills are; excessive production of mucus, reduced respiratory capacity in mucus coated gill filaments, sudden death of fish due to hypoxia and gill epithelial hyperplasia (Boeger and Vianna, 2006).

Ornamental fishes are imported in large numbers to Iran, especially from Southeastern Asian countries. According to the results and due to high monogenean infestation rates of the examined ornamental fishes, it is recommended that all the imported fishes are well quarantined and treated before releasing to the markets. The importation of these monogenean infested fishes not only is cost beneficial but also can change the parasitic fauna of our endemic fishes.

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