Prevalence of *Argulus foliaceus* and Fungal Infections in Some Ornamental Fishes [Discus (*Symphysodon discus*), Dwarf Gourami (*Trichogaster lalius*) and Guppy (*Poecilia reticulata*)] in Isfahan City of Iran

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**INTRODUCTION**

Ornamental fish keeping has become an ever more common hobby global. The trade of ornamental fish is a multi-million dollar industry currently. Several species of ornamental fishes are imported from Southeast Asian countries into other countries such as Iran [1,2]. Fungal diseases of fish are considered to be a chief problem for both aquaculture and fisheries and happen in brood stock and totally life stages of fish and eggs [1,3]. Among many aquatic fungi, *Achlya*, *Penicillium* sp., *Alternaria* sp., *Aspergillus* sp., *Dictyuchus*, *Fusarium solani*, *Protoachlya*, *Pythium*, *Saprolegnia* sp. and *Thraustotheca* were reported [1,3]. Fungus has been reported to cause serious diseases in estuarine and freshwater fishes in Australia, Japan and throughout South Asia [4].
The genus *Argulus* (Crustacea: Branchiura), or fish louse, are common parasites of freshwater fish.[2,5] Nearly 15 spp. are found on freshwater fishes and several of the species are parasitic on marine fishes.[2,6] *Argulus foliaceus* (*A. foliaceus*) have a direct life cycles that because of not need to the intermediate hosts for whole its life cycle and transports rapidly among the fishes.[7] Adults may live free from the host for up to fifteen days. *A. foliaceus* is an obligatory blood sucker and can survive for only a little day without the host fish, depending on size and ambient temperature.[8] A lot of researches have been done on prevalence of *A. foliaceus*, nonetheless the researches on prevalence of this ectoparasite in Iran are limited.[2,5-7,9]

Consequently, this study was designed to find the prevalence *A. foliaceus* and some fungal diseases of ornamental fishes (discus, dwarf gourami and guppy) in Isfahan, Iran. This is the first study on prevalence of *A. foliaceus* in Isfahan, Iran. There is a lack of data on the characterisation and identification of fungal diseases of ornamental fishes in Iran. Such data are significant for fisheries management.

**MATERIAL and METHODS**

The 90 ornamental fish [30 pieces discus (*Symphysodon discus*), 30 pieces dwarf gourami (*Trichogaster lalius*) and 30 pieces guppy (*Poecilia reticulata*)] from 2 pet fish supply store in Isfahan city of Iran (which are imported from Southeast Asian countries such as: Thailand, Malaysia and Singapore into Iran), in the summer 2013 were randomly selected. Then, the fish caught via hand tour and were transported to laboratory of mycology and parasitology in the School of Veterinary Medicine, Islamic Azad University Shahrekord Branch of Shahrekord, in sterile polyethylene bags in aerated aquarium/pond water. The fishes were kept separate in glass aquariums by continuous air supply at ambient temperature. Samples were examined macroscopically, microscopically, clinically for presence of *A. foliaceus* and fungal diseases.

**Identification of Fungi**

For culturing of fungal specimens, three different types of media counting Malt extract agar (MEA), Sabouraud dextrose agar (SDA) and Potato dextrose agar (PDA) were prepared and streptomycin sulphate was supplemented to each preparation of media to avoid bacterial infection. The body surfaces of everything the fishes using in study were disinfected via dipping each fish in 1% formaldehyde for 1 to 5 min followed via 70% alcohol and lastly in sterile water in which it was thoroughly rinsed. The fungal isolates were collected from infected organs (skin, fins, gills, eyes) of fish with sterile needle and inoculated on MEA (Oxoid, UK), SDA (Oxoid, UK) and PDA (M096-India) agars. The agar plates were incubated at 28-30°C and fungal growth was observed after 4-7 days. The fungal colonies of many colors were observed in the agar plates. For microscopic examination, slides were ready from each colony and stained with 0.05% trypan blue in lactophenol. The slides were observed under Olympus microscope and photographed. The fungi were identified by the help of available fungal identification keys and literature.[10]

**Identification of *A. foliaceus***

In the macroscopic technique, contaminated fishes were carried out and their parasites were removed by forceps from different parts of the body. Via microscopic technique (using a compound light microscope at ×10 and ×40 magnification.), the fish were examined via dissecting microscope. The *Argulus* parasites were fixed in 70% ethanol and transferred to laboratory. Then, parasites were identified by the diagnostic key.[11]

**Statistical Analysis**

Prevalence of infection was calculated by using the following formula:

\[
\text{Prevalence of infection (\%) = } \frac{\text{No. of fungal affected fish}}{\text{Total no. of examined fish}} \times 100
\]

**RESULTS**

The study demonstrated that only 2 out of those 90 samples were infested with *A. foliaceus*, meaning 2.22% prevalence. The highest infestation rate was in guppy (6.66%) and no detected in discus and dwarf gourami. Under the light microscope, these parasites were identified at *A. foliaceus* according to the rounded lobes of abdomen and the posterior emargination not reaching the mid-line and posterior lobes cephalothoracic carapace not extended beyond the beginning of abdomen (Fig. 1). In this study, all fish had generalized symptoms including lack of appetite and abnormal swimming. Bloody spots were also observed on skin and fins. In the present study, the distribution of *A. foliaceus* infection on different body regions was examined.

Results of fungal infection by any details showed in Table 1, 2, and 3. The fungal isolates were collected from infected organs (skin, fins, gills, eyes) of fish and the contaminant fungal species were identified as *Acremonium* sp., *Aspergillus* sp., *Alternaria*, *Penicillium* sp., and *Saprolegnia* sp.. The highest infestation rate was in Dwarf gourami (*Trichogaster lalius*) (23.31%), and the lowest infestation rate was in Guppy (*Poecilia reticulata*) (6.66%). A total of 90 fishes of *Acremonium* sp., *Aspergillus* sp., *Alternaria*, *Penicillium* sp., and *Saprolegnia* sp. were examined (Table 1). Fungal infection was observed in discus, dwarf gourami and guppy. However, no *Saprolegnia* sp. infection was no observed in discus and dwarf gourami; no *Acremonium* sp. infection was no observed in guppy; no *Aspergillus* sp.
infection was not observed in dwarf gourami and guppy; no Alternaria infection was not observed in guppy (Table 3).

**DISCUSSION**

In the current study, some ornamental fishes were infected by fungus and *A. foliaceus*. The propagating and rearing of ornamental fish have a remarkable situation in the globe and plays a valuable role in exchange income of several nations and in Occupation. The world trade share of these fish which was estimated about 900 million dollar, has given a vital insight into it [12]. Since of the economic importance of these aquatics, several researchers have paid helpfulness the different factors threatening their importance of these aquatics, several researchers have given a vital insight into it.

Another study in Iran, lionhead goldfish (*Carassius auratus*), taken from a goldfish aquarium with symptoms, were examined for ectoparasites. The parasites collected from the skin and fins of fish were identified as *A. foliaceus*. This is the first report of infection with *A. foliaceus* of lionhead goldfish (*Carassius auratus*) in Iran [8]. Al-Dulaimi [7] in Babylon province of Iraq reported cases of the infection with *A. foliaceus* lice in various goldfish species in the earthen ponds. Notash [15] studied on the goldfishes in east Azerbaijan province of Iran and reported that they were infested by at least one species of crustacean. Results showed that of 300 samples, 85 (28.33%) samples were positive and 215 (71.67%) samples were negative from existence of *Argulus*. Too, Ebrahimzadeh Mousavi et

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**Table 1.** The number and percentage of healthy and fungi infected fishes  
**Tablo 1. Sağlıklı ve mantarla enfekte balıkların sayı ve yüzdesi**

<table>
<thead>
<tr>
<th>Fish Species</th>
<th>Number</th>
<th>Ratio (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Discus (Symphysodon discus)</td>
<td>Infected</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>No Infected</td>
<td>24</td>
</tr>
<tr>
<td>Dwarf gourami (Trichogaster lalius)</td>
<td>Infected</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>No Infected</td>
<td>23</td>
</tr>
<tr>
<td>Guppy (Poecilia reticulata)</td>
<td>Infected</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>No Infected</td>
<td>28</td>
</tr>
</tbody>
</table>

**Table 2.** Frequency percentages of the identified fungi species  
**Tablo 2. Tespitedilen türlerin sıklık oranları**

<table>
<thead>
<tr>
<th>Isolated Fungi</th>
<th>Ratio (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Penicillium sp.</td>
<td>40.0</td>
</tr>
<tr>
<td>Acremonium sp.</td>
<td>26.6</td>
</tr>
<tr>
<td>Aspergillus sp.</td>
<td>20.0</td>
</tr>
<tr>
<td>Alternaria</td>
<td>6.7</td>
</tr>
<tr>
<td>Saprolegnia sp.</td>
<td>6.7</td>
</tr>
</tbody>
</table>

**Table 3.** The percentage of different fungal species isolated from fishes  
**Tablo 3. Balıklardan izole edilen farklı mantar türlerinin oranları**

<table>
<thead>
<tr>
<th>Identified Fungi Species</th>
<th>Fish Species</th>
<th>Total n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Discus n (%)</td>
<td>Dwarf gourami n (%)</td>
</tr>
<tr>
<td>Penicillium sp.</td>
<td>2 (33.3)</td>
<td>3 (42.8)</td>
</tr>
<tr>
<td>Acremonium sp.</td>
<td>1 (16.7)</td>
<td>2 (28.6)</td>
</tr>
<tr>
<td>Aspergillus sp.</td>
<td>1 (16.7)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>Alternaria</td>
<td>2 (33.3)</td>
<td>2 (28.6)</td>
</tr>
<tr>
<td>Saprolegnia sp.</td>
<td>0 (0)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>Total</td>
<td>6 (100)</td>
<td>7 (100)</td>
</tr>
</tbody>
</table>
Prevalence of Argulus foliaceus...

-derived from infestation with this ecto-parasite. Too, lack of good aquarium keeping in pet shops and fish farms increases the chances of fungal infection in fishes. The basic health management practices may be easily over looked due to dearth of trained personal or resources.

REFERENCES


2. Mirzaei M, Khovand H: Prevalence of Argulus foliaceus in ornamental fishes (goldfish Carassius auratus) and Koi (Cyprinus carpio) in Kerman, southeast of Iran [2].

There is a lack of information on the identification and characterization of fungal diseases of ornamental fishes in Iran. Such information is very important for fisheries management. Five fungi, Aspergillus spp., Fusarium spp., Mucor spp., Penicillium spp., and Rhizopus spp., were reported from 8 edible smoked-dried freshwater fishes via Fayiyou et al.[17]. Junaid et al.[18] isolated seven fungal species from stock fish in Nigeria and these included A. flavus, A. fumigatus, A. niger, Trichophyton verrucosum, Rhizopus spp., Mucor spp., and Penicillium spp. and between these Mucor spp., displayed the highest occurrence. In another study, fungi of 8 various genera; Saprolegnia, Aspergillus, Fusarium, Mucor, Penicillium, Rhizopus, Scopulariopsis and Curvularia were isolated from 2 fish species, Oreochromis spp., and Clarias gariepinus [19]. Shahbazain et al.[20] isolated Penicillium expansum, Penicillium citrinum; Aspergillus terruse, Aspergillus clavatus; Alternaria spp.; Saprolegnia parasitic, Saprolegnia lapponica, Saprolegnia kerax and Saprolegnia hypogyna and seven other species of fungi from infected eggs of rainbow trout, Oncorhynchus mykiss in Iran. Fadaeifard et al.[21] isolated eight species of fungi from eggs and brood stock of rainbow trout O. mykiss. These isolates were Penicillium spp., Acremonium spp., Alternaria spp., Fusarium solani, Aspergillus spp., Mucor spp., Saprolegnia spp., and Cladosporium spp. In another study, 5 fungal species viz. Aspergillus spp., Penicillium sp., Alternaria sp., Blastomyces spp., and Rhizopus sp., were isolated from 4 species of carp, C. auratus, L.; Hypophthalmichthys molitrix Richardsons; Labeo rohita Hamilton and C. idella [1]. The fungal genera like Penicillium spp., Fusarium spp., Mucor spp., and Saprolegnia spp., were isolated from Acipenser persicus eggs, where they caused 22% mortality of these eggs [3]. Too, fungal species like Branchiomycetes sp., Saprolegnia sp., and Aphanomyces sp., have also been reported to be pathogenic to fish [3].

Abundance of good aquarium keeping in pet shops and fish farms increases the chances of fungal infection in fishes. The basic health management practices may be easily over looked by reason of lack of trained personal or resources. In the current study, A. foliaceus was reported on guppy (Poecilia reticulata) which this was first recorded in Isfahan, Iran. According to the presented study, it is clear that A. foliaceus can act as a potential risk factor for natural ecosystems and native fish population of Iran and other nations, that should be mentioned to prevent the burst of new parasitic fauna to Iran and various nations as well as stop direct economic losses caused via mortality.

Noamani et al.[6] studied on the 10 various ornamental fishes farm in Iran and reported that 230 pieces of the goldfishes were infested by 3 species of this ectoparasite. Other study, the concurrent fungal and parasitic infection of Argulus foliaceus, was observed in 3 fishes (12.5%). The parasitic infection of A. foliaceus is discussed elsewhere. Five fishes (20.83%) did not show any clinical signs [4]. In the new study in Iran, A. foliaceus was reported on goldfish and Koi which this was first recorded in Kerman, southeast of Iran [2].

REFERENCES


2. Mirzaei M, Khovand H: Prevalence of Argulus foliaceus in ornamental fishes (goldfish Carassius auratus) and Koi (Cyprinus carpio) in Kerman, southeast of Iran.


