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Original Article

Parasites of double tail goldfish, *Carassius auratus* L. imported to Pakistan

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Abstract

This study was planned to investigate parasitic infection of imported ornamental fish, double tail goldfish, *Carassius auratus.* A total of 25 experimental fish were examined for parasitic infection. One fish specimen showed head lesion (1x1cm). Eight different species of parasites were observed on the fish. The gills showed 100% infection by *Dactylogyrus* sp. and mean intensity was 35.4. Fins of the fish also showed high infection (68%) and mean intensity (13.82) by *Gyrodactylus* sp. *Argulus foliaceus* infection on skin and fins was 40% and its mean intensity was found 4.2. Metacercariae of an un-identified digenean were also found encysted on gill filaments (infection 32%, mean intensity 3.87). *Ichthyophthirius multifiliis* infection on fins was found 20% and mean intensity was found 2.4. *Trichodina* sp. infection on fins was 12% (with mean intensity 13). Low infection by *Piscinoodinium pillulare* on fins (8%) and of *Tetrahymena* sp. on fins and gills (4%) was also observed. This study has shown that imported double tail goldfish was not healthy but had parasitic infection. There is an urgent need to have strict check and control over the import of infected and diseased fishes in Pakistan to protect the local biodiversity of Pakistan.

Key Words: Imported, double tail goldfish, parasites, *Dactylogyrus* sp. *Gryodactylus* sp.

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INTRODUCTION

Over 50% of the world's ornamental fish demand worldwide is met by South Asian countries (Olivier, 2003; Gouveia and Rema, 2005). The ornamental fishes are generally tiny and with bright colours and these are admired by the hobbyist (Mandal *et al.,* 2010). It is the body shape, size and colour of the ornamental fish which fetch high market price. About ten varieties in goldfish have been reported by Ahilan *et al.,* (2009) as cited by Iqbal and Rehman (2014). Goldfish is a freshwater fish, widely distributed in the Eurasian continents. Goldfish is the most commonly kept aquarium fish (Komiyama *et al.,* 2009) and there is no other ornamental fish so popular as goldfish. Diseases and pollution in freshwater fishes are great threat to achieve optimum production and hence, become a limiting factor (Chauhan, 2012, Iqbal and Khawar, 2013). Post (1987) stated that the diseases in fishes appear due to poor pond management and unsuitable water quality. However, the common health issues are associated with attack by pathogens such as: parasites, fungi, virus and bacteria.

Fishes are continuously being exposed to many different kinds of pathogenic organisms which may be protozoan or metazoans. Their physiological specialties also make them important hosts to various classes of parasites (Raufi and Awi-Waadu, 2009). Ebert (1998) proved that the diseased fish do not survive very long if accurate diagnosis and proper treatment is not available to fish in time. Infection by parasites points towards water quality issues. The parasites often increase in number in polluted waters (Poulin, 1992; Noga, 2010). Ornamental fish pathogens such as; protozoans, monogenean, digenean, crustacean, spread rapidly in the aquarium and ponds.

According to Iqbal and Rehman (2014) ectoparasites form a large group of pathogens in warm water fishes. The movement of parasites and pathogens along with ornamental fishes from one place to another place is commonly observed worldwide as stated by Iqbal and Haroon (2014). Raufi and Awi-Waadu (2009)

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pointed out that parasites affect the productivity of the fish in the systems through mortalities, decreasing growth rate, reducing the quality of the meat, disfigured the fish and make it unattractive for sale and making the fish more susceptible to even more pathogenic parasites. Recently, Iqbal (2015, 2016) has reviewed the diseases of local culturable and imported ornamental fishes in Pakistan. This study was planned to look into the parasitic infections on skin, gills and fins in double tail goldfish, *Carassius auratus* is imported as pet fish into Pakistan.

MATERIALS AND METHODS

The experimental fish, imported double tail goldfish samples were purchased from aquarium shop locally. The fish samples were brought in aerated water in sterilized plastic bags and kept in glass aquarium (40 liters capacity) with continuous air supply at ambient temperature. The fish was maintained at Fish Disease and Health Management Laboratory, Department of Zoology, University of the Punjab, Lahore. Total length (TL), body depth (BD) and body weight (BW) of each fish was recorded. The fishes were thoroughly observed with the help of magnifying glass for any infection on the body of the fish, fins (dorsal, pectoral, pelvic, caudal and anal), scales, eyes and external body surface of the fish. Lesions, wounds and any other abnormality or ectoparasites were observed on the fish. The parasites which were visible with naked eye such as *Argulus* sp. were counted and recorded. The location of parasites on the body of fish or any other organ was recorded. The slides were prepared by taking mucus from the skin and fins of the fish. The prepared slides were observed under microscope. Then the fins and gill arches were removed and placed on clean glass slide and observed under microscope. The parasites were identified according to Kabata (1985) and Post (1987). Photographs of fishes and parasites from wet mount prepared slides were taken by digital camera fitted on the microscope.

RESULTS

During the present study total of 25 specimens of double-tail goldfish were examined from May to July 2015. Body weight of fish ranged from 4.70 to 12.70 g. The mean body weight was 7.74 g. Total length of fish ranged from 5.7 to 7.5 cm. The mean total length was 6.65 cm. Body depth ranged from 2.1 to 3.5 cm. Clinically twelve fishes were found healthy with no external lesions and injuries. Three fishes showed fade coloration of skin and excessive mucus secretion. Two fishes showed blackening of the dorsal fin. Three fishes showed damaged tips of caudal fin. One fish showed lesion (1x1cm) on head between both eyes due to *Argulus foliaceus* attack (Fig. 1), one fish had swollen belly.

Table I: Parasitic fauna of double tail goldfish *Carassius auratus*

Parasite	No. of fish examined	No. of fish infected	Prevalence (%)	No. of parasites	Mean Intensity	Site of infection
Dactylogyrus sp.	25	25	100%	885	35.4	Gills
Gyrodactylus sp.	25	17	68%	235	13.82	Fins
Argulus foliaceus	25	10	40%	42	4.2	Fins =36 Skin= 16
Metacercariae	25	8	32%	31	3.87	Gills
Ichthyophthirius multifiliis	25	5	20%	12	2.4	Fins
Trichodina sp.	25	03	12%	39	13.0	Fins
Piscinoodinium pillulare	25	02	8%	9	4.5	Gills = 3 Fins = 6
Tetrahymena sp.	25	01	4%	7	7.0	Fins = 4 Gills =3

Eight species of parasites were recorded from the fish. The prevalence of *Dactylogyrus* sp. from gills was 100%. The prevalence of other parasites; *Gyrodactylus* sp. 68%, *A. foliaceus* 40%, Metacercariae 32%, *I. multifiliis* 20%, *Trichodina* sp. 12%, *P. pillulare* 8% and *Tetrahymena* sp. 4% (Table I). All 25 fish were found infected and a total of 1720

parasites were found on them. The mean intensity was 68.8 and the abundance was 68.8. The gill filaments were observed to be affected with 4 types of parasites.

The highest infection was of *Dactylogyrus* sp. which was present on each gill filaments. The fish were 100% infected with *Dactylogyrus* sp. Eighteen fishes showed less infection on gills, two fish had mild gills infection and heavy gills infection was observed in 5 fish samples (Fig. 2). Unidentified metacercariae were found on gills of 8 fish but infection was mild. *Piscinoodinium pillulare* and *Tetrahymena* sp. was found on 2 and 1 fish respectively with low infection.

Figure 1: A head lesion (1x1cm) on double tail goldfish. One *Argulus foliaceus* is seen attached on front of lesion.

Table II: Parasitic Infection in relation to Body Weight of double tail goldfish

BW. Class	Weight Range(g)	No. of fish	Mean BW (g)	Minimum Parasites	Maximum Parasites	Total Parasites	Mean Intensity
1	4.0–6.0	3	5.25	25	146	213	71.0
2	6.1–8.0	13	7.05	18	85	644	49.54
3	8.1–10.0	6	8.79	33	271	788	131.3
4	10.1–12.0	2	10.31	10	28	38	19.0
5	12.1-14.0	1	12.70	-	37	37	37.0

Table III: Parasitic infection in relation to total Length of double tail goldfish

Length Class	Length Range(cm)	No. of fish	Minimum Parasites	Maximum Parasites	Total Parasite	Mean Intensity
1	5.5 – 6.0	3	38	147	225	75.0
2	6.1 – 6.5	9	25	271	910	101.1
3	6.6 – 7.0	6	18	146	335	55.83
4	7.1 – 7.5	7	10	66	250	35.71

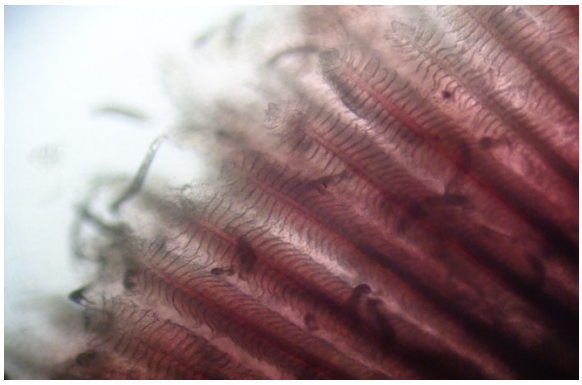

Figure 2: *Dactylogyrus* sp. attached in the middle and tips of gill filaments of double tail goldfish.

Fins of double tail goldfish were found affected with 6 species of parasites with different prevalence. Out of 25 specimens, the fins of 17 fish samples were infected with *Gyrodactylus* sp. Only ten fishes were infected with *A. foliaceus* and infection was mild. *Ichthyophthirius multifiliis* was found on 5 fish, *Trichodina* sp. *P. pillulare,* and *Tetrahymena* sp. was found on 3, 2 and 1 fish respectively. According to body weight fishes were divided in to five classes (class 1 (4.0-6.0g), class 2 (6.1-8.0g), class 3 (8.1-10.0g), class 4 (10.1-12.0g) and class 5 (12.1-14.0). The highest overall mean intensity of infection (131.3) was recorded in class 3, and lowest value (19) was in class 4 (Table II). As per length class, there are four classes (class 1 (5.5-6.0cm), class 2 (6.1-6.5cm), class 3 (6.6-7.0cm) and class 4 (7.1-7.5cm). The highest overall mean intensity of infection (101.11) was observed in class 2 and lowest value (35.71) was shown by class 4 (35.71) (Table III).

DISCUSSION

During present study 25 double tail fish samples were examined for parasitic infection. In total 8 different species of parasites were observed in the fish. These parasites were: *Dactylogyrus* sp., *Gyrodactylus* sp., *A. foliaceus*, Metacercariae of digeneans, *Ichthyophthirius multifiliis*, *Trichodina* sp., *Piscinoodinium pillulare* and *Tetrahymena*. Iqbal and Rehman (2014), Iqbal and Noreen (2014) also observed these parasites from two verities of imported goldfish, comet and fantail.

The most common parasite was *Dactylogyrus* sp. which showed 100% infection. Gill infection by *Dactylogyrus* sp. proves very fatal to fish as a result of gill damage (Post, 1987). Due to infection the function of gills is impaired and fish become restless. Shamsi *et al.,* (2009) reported 18 *Dactylogyrus* species including *Dactylogyrus extensus, Dactylogyrus vastator* from imported cyprinid fish in Iran. *Gyrodactylus* sp. exhibited low infection in double tail goldfish. This parasite cause low pathogencity as compared to *Dactylogyrus* sp. So, mild damage is observed on scales, fins and skin. However, the fish infected by *Gyrodactylus* sp. may develop whitish area of mucus on the skin. The findings of this study may be compared to the work of Tavares-Dias *et al.,* (2010), Chanda *et al.,* (2011) and Iqbal and Hussain (2013).

High infection of encysted metacercariae of digenean on gills filaments was observed which may also prove to be fatal to fish. Infection of *I. multifiliis* on skin and fins results in irritation, detachment of epidermis and mucus production, whereas gill infection cause respiratory problem (Tavares-Dias *et al.,* 2010). In heavy infection, 100% fish mortality can occur. Infection by *I. mulltifiliis* cause white spot disease in fishes. This parasite is low host specific and widely distributed in freshwater fishes (Tavares-Dias *et al.,* 2010; Iqbal *et al.,* 2013a). *Trichodina* sp. showed low infection in double tail. However, they occur in large numbers on fish under stressed conditions in ponds due to poor water quality and overcrowding, these parasites can proliferate massively and become serious ectoparasites (Lom and Dykova, 1992). *Tetrahymena* sp. also showed low infection in present study. *Tetrahymena* sp. infection has also been reported from six ornamental fishes viz., *Poecilia reticulate, C. auratus, Poecilia sphenops, Puntius* sp. *Pterophyllum scalare, C. carpio* (Thilakaratne *et al.,* 2003) from *Carnegiella strigata* (Tavares-Dias *et al.*, 2010) and in guppy, *P. reticulata* (Leibowitz and Zilberg, 2009). *Tetrahymena* infection is known as guppy disease. *Piscinoodinium pillulare* show 8% infection. This is comparable to the findings of Iqbal and Haroon (2014)

Mild infection of *A. foliaceus* is also found in double tail goldfish. Low infection of *A. foliaceus* was also observed in fantail goldfish (Iqbal and Noreen, 2014). However, it is potentially a serious pathogen of commercial fish (Iqbal *et al.,* 2013b). Infection as high as 1000 parasites per fish may cause mortality in common carp (Pekmezic *et al.,* 2009).

The body weight class 3 (8.1-10.0 gm) had high parasitic load and mean intensity. The length class 2 (6.1-6.5 cm) had high parasitic load and mean intensity. Due to heavy infestation of parasites, there was high mucus secretion in all fish samples and some fish showed fade coloration.

Conclusions

The findings of this work have clearly indicated that double tail goldfish imported into Pakistan had parasitic infection. An urgent step is needed to control the import of infected fishes in Pakistan. However, if this practice continues there is a risk of spreading such parasitic infection in local fish species. Moreover, it may probably affect the pet fish industry in our country. Strict regulations on the import of ornamental fishes should be implemented.

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