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Original Article

A survey of parasitic infection of ornamental fishes in Urmia, Iran

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ABSTRACT

Nowadays, ornamental fish are considered to be of value in most countries due to their beauty and variety. The living, beautiful and lively environment of aquariums has made people to be interested in having an aquarium, however small in size, at their home or work. The main aim of this study is to identify the parasitic elements in ornamental fish (92 Gold fish, 32 Oscar fish, 18 Flower fish, 24 Arvana fish and 41 Discus fish) that are culled from fish breeding centers in Urmia. Classification of the fish was carried out based on their morphological characteristics. The results of the study indicate the presence of parasitic infection of these fish in four protozoan species including *Ichthyophthirius multifiliis*, *Trichodina* spp, *chilodonella* spp and *Hexamita* spp. Also, *Diplostomum spataceum*, *Dactylogyrus* spp and *Gyrodactylus* spp were observed from monogenea and digenea trematodes and *lernaea* spp from crustose parasites.

بررسی آلودگی انگلی ماهیان زینتی در ارومیه ، ایران

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چکیده

امروزه ماهیان زینتی (Ornamentalfish) به دلیل زیبایی و تنوع بسیاری که دارند در اغلب کشورهای جهان مورد استقبال قرار گرفته اند. محیط زنده و زیبا و پر تحرک آکواریوم ها سبب گردیده که انسان ها به داشتن یک آکواریوم هر چند کوچک در خانه و یا محل کار خود علاقه نشان دهند. این تحقیق جهت شناسایی عوامل انگلی بیماریزای ماهیان زینتی آب شیرین مراکز تکثیر و پرورش فعال شهرستان ارومیه انجام گرفت ، بدین منظور ، پنج گونه ماهی زینتی آب شیرین شامل ۹۲ قطعه گلد فیش یا ماهی طلائی (*Carassius auratus*)، ۳۲ قطعه ماهی اسکار (*Astronotus ocellatus*)، ۲۴ قطعه ماهی آروانا (*Osteoglossum bicirrhosum*) ، ۴۱ قطعه ماهی دیسکاس (*Symphysodom discus*) و ۱۸ قطعه ماهی فلاور (*Flower Horn*) جهت بررسی های انگل شناسی مود مطالعه قرار گرفتند. نتایج بدست آمده نشان دهنده وجود آلودگی انگلی ماهیان مذکور به چهار جنس و گونه تک یاخته شامل *Ichthyophthirius multifiliis* ، *Trichodina spp* ، *Chilodonella spp* ، *Hexamita spp* و همچنین از ترماتودهای مونوژنه آ و دی ژنه آ انگل های *Diplostomum spataceum*، *Dactylogyrus spp* و *Gyrodactylus spp* و از انگل های سخت پوست، *Lernaea spp* بود.

واژه های کلیدی: انگل ، ماهیان زینتی ، آکواریوم ، ارومیه

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INTRODUCTION

According to the FAO, about 150 countries in the world are engaged in the breeding of ornamental fish. Countries like Singapore, Malaysia and Thailand are the leading producers and exporters of these ornamental fish securing secured a good record in the world trade [3]. In the meantime, Singapore, with its favorable climate and climatic conditions, has become the center of the World Trade. It breeds Ornamental Aquaculture fish and exports millions of species of ornamental aquatic animals to all parts of the world every day. Thus, providing the public with useful and easy-to-understand information on these would be very beneficial [4]. Parasitic diseases have a long way to go in pond farming fish, and the parasite's life cycle type and simplicity shorten the incubation period and cause symptoms to appear [8]. Parasitic infections often begin in the spring; when the pool water starts to heat up [6]. The parasites then reach the maximum growth, reproduction, and production of their offspring during the summer. The higher the density of fish in the ponds and the more unfavorable the breeding and health management, the better the conditions for the spread of parasites and disease, and death [17].

MATERIALS AND METHODS

In this study, with previous coordination with vendors and officials of ornamental fish breeding centers in Urmia, five species of fish including 92 pieces of goldfish (*Carassiusauratus*), 32 pieces of Oscar (*Astronotusocellatus*), 24 pieces of Arvana (*Scleropages spp*), 41 Symphysodon fish and 18 Flower Horn fish were examined for parasitic factors. The fish were classified based on their morphological characteristics. The live fish samples were transferred to the parasitology laboratory of the Islamic Azad University, Urmia Branch by means of plastic containers equipped with oxygen capsules, and were temporarily stored in pre-prepared aquariums. Transmitted fish generally had clinical and physical signs of disease, although in some cases seemingly healthy fish were used to control them. After transferring the samples to the laboratory, in order to facilitate the work and perform complete experiments on the fish, the fish were anesthetized using biochemistry (MS-222) and biometrics were performed and fish Using Berg, Berd, coad and Abdi [1] identification keys, the fish species were identified and approved, and then all fish information including species name, sample number, length and weight along with sample date were entered in special tables prepared for this purpose.

In the early stages of this study, the specimens were examined macroscopically for the condition of the skin, fins, and external parts of the body for external damage, and any lesions were examined using a loop and a microscope. From various organs including skin, eyes, fins, and gills, external parasites were sampled through wet slides, and based on the Abdi [1], they were isolated and confirmed. The use of Guso identification keys for monogenic and crustaceans and Loom and Daiko for protozoa and mixed to sex were examined [3]. First, to examine skin parasites and fins, all parts of the skin are examined for appearance and macroscopic parasites, and then by drawing a wet slide on the skin and fins, especially the pectoral, ventral, and anterior fins, microscopic parasites were studied. Examination of gill parasites was first examined by lifting the gill cover, and then the whole gill arches were removed with scissors and their surface was examined microscopically. To examine eye parasites using pliers and scalpel, we completely removed the eyes from the eye

socket and placed them in a petri dish containing distilled water, and after removing the lens, placed its various parts, including the liquids inside the eyeball, under a stereomicroscope. Then the isolated lens were placed between two slides and gently crushed with pressure. A drop of physiological serum was added to it and then the parasite was examined with more magnification. To examine the gills and the surface of the gills with the help of a microscope, the microscopic lesions were examined and then each of the gill arches was removed separately by scissors and placed in a dish containing distilled water to prevent drying. Wet slide preparation method was carefully employed. Two drops of a solution containing concentrated common salt were used to accelerate the parasite harvest, which caused numbness in foreign parasites and made them easily separated from Gill tissues. They are then dissected using a dissection pen and a pasteurized pipette, and stored in 70% ethanol, and after fixation to glycerin, a jelly is prepared and transferred to Wilson identification keys [1, 15].

RESULTS

The results were obtained from the study of parasitic infection of 207 ornamental fish are presented in Table 1.

Results of parasitic infestation of Goldfish (Carassius auratus)

In this study parasitic infection of the skin and gills of goldfish, 3 protozoan species of *chilodonella spp*, *Trichodina spp*, and *Ichthyophthirius multifiliis* were observed. The percentage of protozoan infection was 30.43% for *Ichthyophthirius multifiliis*, 15.21% for *Trichodina spp*, and 8.69% for *chilodonella spp*, respectively. *Dactylogyrus spp* parasitic monogenic trematodes with 14.13% and *Gyrodactylus spp* 7.60% were also observed. *Diplostomum spataceum* parasite was observed and recorded from *Digena* trematodes with 46.73% contamination of ocular lens. Also, a species of hard skin parasites including *lernaea spp* with 3.26% were identified (Table 2).

Table 1: Results of total fish parasitic infection in the present study

Fish name	Scientific name	Numbers of the fish	Number of infected fish	Percentage of infection
Goldfish	*Carassius auratus*	92	63	68.47
Symphysodon	*Symphysodom discus*	41	33	75
Oscar	*Astronotus ocellatus*	32	9	28.12
Arvana	*Osteoglossum bicirrhosum*	24	9	32.14
Flower Horn	*flowerhorn*	18	2	11.11

Table 2: Investigation of the frequency and percentage of infection of parasites isolated from goldfish

Parasite scientific name	Infected organ	Number of infected fish	Average number of parasites	Percentage
Ichthyophthirius multifiliis	Skin	28	21	30.43
Trichodina spp	Gills, skin	14	23	15.21
chilodonella spp	Skin and fins	8	12	8.69
myxobolus spp	Skin and fins	5	18	5.43
Dactylogyrus sp	Gills and fins	13	6	14.13
Gyrodactylus spp	Gills	7	3	7.60
Diplostomum spp	Fisheye lens	43	4	46.73
lernaea spp	Gills, skin	3	3	3.26

Table 3: Frequency and percentage of infection of parasites isolated from discus fish

Parasite scientific name	Infected organ	Number of infected fish	Average number of parasites	Percentage
Ichthyophthirius multifiliis	Skin and fins	28	11	31.70
Trichodina spp	Gills	14	3	17.07
chilodonella spp	Skin	8	18	9.75
Dactylogyrus sp	Gills	13	36	14.63
lernaea spp	Skin	3	2	3.26

Table 4: Frequency and percentage of infection of parasites isolated from Oscar fish

Parasite scientific name	Infected organ	Number of infected fish	Average number of parasites	Percentage
hexamita spp	Skin, gills, muscles	4	5	12.50
Trichodina spp	gills	2	35	6.25
Ichthyophthirius multifiliis	skin	3	21	9.37
Cryptobia leidy	Gills, skin	1	4	3.12
Dactylogyrus sp	Gills	3	8	9.37
lernaea spp	skin	1	3	3.12

Table 5: Frequency and percentage of parasite infestation isolated from Arvana fish

Parasite scientific name	Infected organ	Number of infected fish	Average number of parasites	Percentage
Trichodina spp	gills	6	6	25
Ichthyophthirius multifiliis	skin	7	21	29.16
Dactylogyrus spp	gills	2	4	8.33

Table 6. Frequency and percentage of infection of parasites isolated from Flower horn fish

Parasite scientific name	Infected organ	Number of infected fish	Average number of parasites	Percentage
Ichthyophthirius multifiliis	gills	2	36	11.11

Results of Symphysodom discus parasitic infection

In this study of parasitic infection of skin and gills of 41 discus fish, 3 protozoa of *chilodonella spp*, *Trichodina spp*, and *Ichthyophthirius multifiliis* were equal to *Ichthyophthirius multifiliis* 31.70%, *Trichodina spp* 17.07%, *chilodonella spp* 75.9%, respectively. Also, *Dactylogyrus spp* parasite monogenic trematodes with a contamination percentage of 14.63% were observed. From hard-skinned parasites, *lernaea spp* parasite was detected with discus percentage of 3.26% in discus fish (Table 3).

Results of parasitic infection of Oscar fish (Astronotus ocellatus)

In this study of parasitic infection of skin and gills of 32 Oscar fish, 4 protozoa of *hexamita spp*, T*richodina spp*, *Ichthyophthirius multifiliis* and *Cryptobia leidy* were equal to *hexamita spp* 12.50%, *Trichodina spp* 6.25%, *Ichthyophthirius multifiliis* 97%, *Cryptobia leidy* 3.12% was observed. Also, *Dactylogyrus spp* parasitic monogenic trematodes with a contamination percentage of 9.37% were observed. From hard-skinned parasites, the parasite *lernaea spp* with an infection rate of 3.12% was identified in Oscar fish (Table 4).

Results of parasitic infection of Arvana (Osteoglossum bicirrhosum)

In the study of parasitic infection of skin and gills of 24 studied Arvana fish, two protozoan species *Trichodina spp* and *Ichthyophthirius multifiliis* were observed equally to *Trichodina spp* 25%,

Ichthyophthirius multifiliis 29.16%, respectively. *Dactylogyrus spp* parasitic monogenic trematodes with an infection rate of 8.33% were also observed (Table 5).

Results of parasitic infection of Flower horn (Flower horn)

Only one protozoan species of *Ichthyophthirius multifiliis* with a contamination percentage of 11.11% was observed in the parasitic infection of the skin and gills of 18 Flower horns (Table 6).

DISCUSSION

Ornamental fish parasites, especially carnivorous ornamental fish, have rarely been studied in Iran and in the world. There are about 170 species of aquarium fish in Iran, of which only 40-50 species are bred in the country. Due to the fact that most ornamental fish, especially carnivorous ornamental fish are imported , understanding their parasitic diseases would be of importance as in some cases they act as a reservoir of infection. Some studies have been conducted on the contamination of aquarium fish with parasites [3]. investigated the contamination of Camallanuscotti nematode in guppies imported to Korea. They found the parasite on dead fish but did not consider the parasite to cause fish death because they also found the Terahymenacorlissi ciliated parasite and concluded that the two parasites co-caused the death of guppies [13]. Cable and Oosterhout [9]investigated the severe effect of parasitic infection on the evolution of guppies and their effect on the host and found that the host's living conditions and reproductive capacity can affect the survival and population of the parasite [15]. investigated the discovery of the trypanosome gene in freshwater fish, including carp or goldfish [13]. conducted a study comparing the infestation of worm parasites among different age groups of sludge-eating catfish in northern Nigeria and concluded that the infestation of worm parasites in sludge-eating fish is adult fish. They had more young fish. [16] isolated worm parasites in Cichlid and posilid fishes of Central America and reported that nematodes, monogenes, and trematodes were the most infected, respectively [12]. Gregory identified the most important fungal parasites and diseases in aquarium fish, among which *Saprolegnia* was the most fungal infection and they isolated protozoa from parasites more than other groups of trematodes and nematodes [5]. Barber (2017) conducted extensive research on the effect of parasites on fish behavior and relaxation [2]. Molnar et al. (1987) have published a scientific report on the density of parasites and parasitic diseases in freshwater fish in Iran. In aquarium conditions, due to the low volume of water and high density of fish, the prevalence of skin and gill parasites has been higher than other parasites. *Dactylogyrus*. Spp and *Ichthyophthiriu multifiliis* were the most common parasites isolated from the skin and gills of aquarium fish [14].

Rahulkova et al. attempted to control one parasite through chemotherapy and electrotherapy. Of course, parasite can also be treated with sodium bicarbonate bath and water filter [16]. These parasites do not need an intermediate host and spend their entire lives on one host. Among the aquarium fish studied, Oscar fish had the highest percentage of infection with monogenic trematodes and its host was 90%, related to skin and gills. After the parasite *Dactylogyrus Spp*. The parasite *Ichthyophthirius multifilis* had the highest rate and its percentage in scar fish was reported to be 66% in the skin and gills. Different stages of the parasite life cycle have been observed on the skin and gills of fish infected with the parasite *Ichthyophthirius multifilis*, and the characteristics of each stage have been correctly identified. Replacement of these parasites on the gills of fish leads to respiratory failure in such a way that in severe pollution, the fish comes to the surface and swallows the air or clings to the air stone. In some cases, the color of the fish's body darkens. Rasouli et al. (2011) examined the monogenic trematodes of some Iranian fish. In this study, the most isolated species were *Dactilogillus* and *Girodactylius* [15]. examined the intestinal monogens of fish (based on the dactylogeride family). Gussev et al. (1993) introduced new species of *Dactylogyrus* in Iranian freshwater fish and isolated 6 new species of *Dactylogyrus* [6]. *Hexamita* parasite is an internal parasite and causes

chronic intestinal diseases. This parasite causes disease in conditions such as poor nutrition, lack of oxygen and high density. In Oscar fish where the *hexamita* parasite was isolated, a hole was observed in the head area, which is also caused by the *hexamita* parasite. Sometimes the parasite reaches the skull through the bloodstream and infects the skull by infecting the cartilage. The parasite also infects other organs, including the liver and heart [13]. Masoumian (1995) has isolated the *myxospora* parasite from fish in Khuzestan province [10]. *Myxobulus* parasite was isolated from the intestines of goldfish, which is reported to be 23%. Crustaceans isolated from the studied fish belong to the genus *Lernaea* and in guppy fish, 13% was observed, which was isolated from the fish skin. Of course, 6% has been reported in goldfish. Despite numerous works done by researchers in Iran, there are no credible reports about aquarium fish in the country. Mokhayer (2002) isolated Lorraine parasite from carp in fish farms in Iran. This parasite causes more problems in aquarium fish than other fish because it is a parasite attached to the fish skin. It affects the marketability and shape of the fish and reduces the value of the fish. They are separated, but the wound becomes the center of viral, bacterial, fungal, etc. infections and kills the fish [12].

In a study, parasitic infections of various organs of some aquarium fish in Ahvaz were examined. In this study, parasitic contamination of various organs of goldfish, scars, guppies, and glued glassfish was investigated. In this study, a total of 120 pieces of fish (30 pieces per fish) were examined. Of the 30 goldfish studied, all 30 were infected with a variety of parasites, of which 80% were monogenic trematodes, 66% were protozoa and 6% were crustaceans. Out of 30 scars, 27 (90%) were infected with parasites, of which 90% were monogenic trematodes and 72% were protozoa. Of the 30 guppies studied, 15 were infected with parasites, of which 23% were monogenic trematodes, 13% were protozoa, and 13% were crustaceans. Of the 30 glued glassfish studied, 18 were 60% infected with various parasites, of which 60% were Mongen trematodes and 13% were protozoa, respectively. The highest level of infection has been observed in the skin and gills. The parasites identified in these fish were: *Dactylogyru spp* monogenic trematode, protozoa, *Ichthyophthirius Multifiliis*, *Mxyobolus spp*., *Trichodina spp*., *Cryptobia spp*. and *Hexamita spp*. Crustacean *Argalus foliaceae* is just one of the parasitic findings of the fish examined in this paper. However, it indicates the abundance of this parasite in the surface of hydrothermal farming fish and aquarium ornamental fish. On the surface of the skin as well as on the surface of the gill rays, it weakens the wall of the fish's defense barrier against pathogens and causes the spread of secondary diseases such as bacterial, fungal, viral and even other parasitic diseases [7]. Also, the protozoan parasite *Hexamita* has always been reported as one of the most important parasites of Oscar fish. This study also confirmed the presence of this protozoan in most Oscar fish. The Oscar fish, also known as the peacock or cichlid, is one of the most important aquarium ornamental fish that has been considered by ornamental fish lovers for 60 years. Perforation syndrome is a disease that is similar to lateral line abrasions and head diseases in freshwater and saltwater fish. It is believed that the main cause of perforation in the head of the parasite was the flagellate parasite *Hexamita* and two other diseases (perforation syndrome in the head and fin abrasion) In a study conducted by Rasouli et al., out of 74 Oscar fish with an average age of 3 to 5 years, *hexamita* parasite was observed in 19 pieces. 19 out of 74 (25.67%) of the mentioned fish were infected with *hexamita* parasite and had clinical signs of permanent or periodical perforation syndrome in the head. Of these 19 infected fish, 11 had severe complications [8].

CONCLUSION

According to the results of the present study, the most contamination of goldfish with foreign parasites, namely single-host types, has occurred due to the lack or reduction of fish contact with intermediate hosts and thus reduced the incidence of multifamily parasites. Of course, the results of other studies such as Tekin Ozan et al [18], Mahmoud et al [9], Rahulkova et al. [16], Molnar et al [13]also confirm our findings. Rasouli. et al [15], in their findings, generally referred to foreign parasites like

monocotyledonous species. Finally, to prevent the spread of parasitic diseases among ornamental fish, the following is suggested: In general, in order to reduce the effects of parasitic diseases, some structural reforms should be made in the process of import and management, knowing that most of the ornamental fish traded and maintained in the country enter the market through direct importation. Certain measures should be taken to secure the procurement and import from reputable global markets under the supervision of the World Health Organization and FAO. Also, the management of aquatic quarantines at the entry points of fish into the country and their distribution should be monitored. The health and safety of the imported fish in stores , domestic markets and the smallest storage units should be monitored too. After managing these preventive measures, the possibility of diseases is still not far from the mind. Thus, appropriate treatment measures and therapeutic drugs should be used with the advice of the experts.

ETHICS

Approved.

CONFLICT OF INTEREST

None declared.

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