Survey of parasitic fauna of different ornamental freshwater fish species in Iran

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Abstract
Parasitic diseases are harmful and limiting factors in breeding and rearing ornamental fish industry. In this study, 400 apparently healthy ornamental fishes from five species (each species 80 specimens) including: Goldfish (Carassius auratus), guppy (Poecilia reticulata), angelfish (Pterophyllum scalare), discus (Symphsodon discus) and sailfin mollies (Poecilia latipinna) were obtained from a local ornamental fish farm in the north of Iran during 2011 to 2012. The primary purpose of this study was to determine the parasitic infections of aquarium fish in Iran. For this purpose, fish were first examined for ectoparasites using wet mount under a light microscope. Then, the alimentary ducts of fish were observed under light and stereo microscope. In survey of different infection rates for different parasitic infections in examining fish: Dactylogyrus sp., Gyrodactylus sp., Ichthyophthirius multifiliis, Trichodina reticulata, Capillaria sp. and Lernaea cyprinacea were collected from five species. All five fish species had Monogenea (Gyrodactylidae and Dactylogyridae) in their skins and gills, the highest prevalence was observed in C. auratus and the lowest was in P. scalare and S. discus. Also, Capillaria sp. was reported as a first record from the abdominal cavity of P. scalare in Iran. Our findings revealed that the protozoal infections are very common among aquarium fishes. Although, no gross pathology was observed among infected fishes, but it is likely that in case of any changes in the environment, then parasitic infections could be harmful.

Key words: Iran, Ornamental Fish, Parasites

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چکیده
بررسی فون انگلی گونه های مختلف ماهیان آکواریومی آب شیرین در ایران

چکیده
به‌عنوان یکی از عوامل مضر و محدود کننده صنعت تکثیر و پرورش ماهیان زینتی، فون انگلی ماهی‌های زینتی در کاربردهای التهیه‌آوری به گونه‌های مختلف مورد استفاده قرار می‌گیرند. در این مطالعه، نمونه‌برداری از ماهیان زینتی شامل: ماهی حوض (Carassius auratus)، ماهی گوپی (Poecilia reticulata)، ماهی آنجل (Pterophyllum scalare)، ماهی دیسکاس (Symphsodon discus) و ماهی مولی (Poecilia latipinna) از مزارع ماهیان زینتی در استان مازندران در سال‌های 1391 تا 1392 انجام گردید. در این مطالعه، با استفاده از میکروسکوپ نوری و لوپ، گونه‌های مختلف فون انگلی مورد بررسی قرار گرفت. نتایج نشان داد که بیشترین شدت آلودگی در ماهی حوض و کمترین میزان آلودگی در ماهیان آنجل و دیسکاس مشاهده شد. انگل‌های کاپیلاریا، لرنیا، در ماهیان این گروه مورد شناسایی قرار گرفتند. نتایج نشان داد که بیشترین میزان آلودگی در ماهی حوض و کمترین میزان آلودگی در ماهی گوپی ماهی‌های زینتی بوده و سایر گونه‌ها در بین این دو گروه قرار گرفته‌اند.
Introduction

Aquarium fish trade is a very important sector all over the world. The global trade in ornamental fish, associated aquarium and pond accessories is more than 7 × 10^9 USD each year. They are a significant source of overseas benefit for many rustic communities in Africa, south America and south-east Asia. Thousands types of aquarium fish (commonly, poeciliids, guppy and cichlids) are collected and maintained by hobbyists. The biggest portion of the aquarium fish industry is the freshwater aquarium fish sector. Cultivation and propagation of ornamental fishes have been increased in the recent decades in Iran, for its beautiful appearance, the small size and easy maintenance.

Although this worldwide interest in ornamental fish has led to development in their cultivation techniques, there are still many difficult-to-culture species with high demand. Ornamental fish pathogens spread very rapidly in the world because of their commercial benefits. Consequently, routine infectious disease controls are very important for risk analysis and precaution steps. Parasites are harmful and limiting factors in breeding and rearing ornamental fish industry. From economic aspects, parasitic diseases in fish have a particular importance, because of causing sterility, discoloration, change of body shape and decreased growth and weight of fish. Therefore, knowledge about fish parasites is crucial for successful aquaculture. For this reason, we aimed to isolate and identify the parasitic fauna of five species of ornamental freshwater fish in northern Iran.

Materials and Methods

A total number of 400 apparently healthy ornamental fishes including Goldfish (Carassius auratus; n = 80), guppy (Poecilia reticulata; n = 80), angelfish (Pterophyllum scalare; n = 80), discus (Symphysodon discus; n = 80) and sailfin mollies (Poecilia latipinna; n = 80) were obtained from local ornamental fish farms in Mazandaran province (North of Iran) between 2011-2012, (Table 1). Live fishes were transferred to fish diseases laboratory at the Caspian Sea Ecology Research Center using portable air pump.

The external surface, abdominal cavities and digestive tracts were examined for presence of parasitic fauna. Fish were first examined for ectoparasites using wet mount under a light microscope (Olympus, Tokyo, Japan). Then, the alimentary ducts of fish were observed under light and stereo microscope. Parasites of alimentary tracts were counted and fixed in 70% ethanol, and for examination, they were cleared using glycerine. Identification of the parasites was carried out using the identification keys.

### Table 1. The geographical distribution of sampling in each examined fish species in the Mazandaran province, Iran.

| Fish species            | Region/Location of sampling |
|-------------------------|----------------------------|
| Pterophyllum scalare    | Sari, Tonekabon            |
| Carassius auratus       | Babolsar, Amol, Sari       |
| Symphysodon discus      | Feridonkenari, Tonekabon   |
| Poecilia latipinna      | Joibar, Sari, Babol        |
| Poecilia reticulata     | Tonekabon, Sari, Babolsar  |

Results

During the sampling, the water temperature was 25 ± 3°C, dissolved oxygen was 4.60 ± 0.50 mg L⁻¹ and pH was 7.20 ± 0.60, respectively. Of all examined fishes, 380 fishes (95.00%) were infected by at least one parasite. One nematode (Capillaria sp.), two protozoa (I. multifilis and Trichodina reticulata), two monogeneans (Dactylogyrus sp. and Gyrodactylus sp.) and one Crustacea (L. cyprinacea) were identified (Figs. 1 to 5 and Table 2). The hemorrhagic areas on the skin and gills, fins bleeding, scales losing and fin rot was observed in infected fish.

Fig. 1. Trichodina reticulata isolated from discus (400×).

Fig. 2. Two pairs of anchor hooks (arrow) of Gyrodactylus sp. isolated from guppy (100 ×).

Fig. 3. Anchors of Dactylogyrus sp. (Total length of anchor = 48.5 μm) isolated from Goldfish (100 ×).
During the previous decades, fish parasites identification have become increasingly visible, because of the growth of freshwater ornamental fish industries throughout the world. Parasitic diseases affect physiologic and biologic characteristics, caused mechanical damage and economic losses in ornamental fish industries.

Different parasite species were reported from various ornamental fish species around the world. Tetrahymena sp. was collected from gills of Carassius auratus, Piscinoodinium pilulare from the skin of Carassius martae, Trichodinids spp. from the skin of C. strigata, also Nannostomus and Procamallanus sp. was isolated from the intestine of Paracheirodon axelrodi. Koyun reported Gyrodactylus katharine and Gyrodactylus carassii from the gills of C. carassius, Ichthyobodo sp., I. multifiliis, Chilodonella sp., Trichodina spp. from the skin, Dactylogyrus extensus, Gyrodactylus bullatarudis, L. cyprinicaea, Argulus foliaceus, Argulus japonicus and Capillaria sp. from the external parts of goldfish, guppy and cichlids. Ambiphyra spp. was reported from the skin of guppy, and also, Oodinium piliularis was isolated from the skin of Poeciliidae.

In Iran, there were also many reports of parasite fauna from ornamental fishes for example, Meshgi et al. reported Dactylogyrus rotator, Chilodonella sp., Hexamita sp., Ichthyobodo necator, I. multifiliis, Microsporidium, Myxosporida sp., Trichodina spp., and L. cyprinicaea from Aquarium fishes around Tehran.

**Table 2. Parasitic fauna in ornamental fish in Mazandaran province according to this study.**

| Host          | Parasites              | Infected organ | Infected fish (%) | Range of infestation/Infection |
|---------------|------------------------|----------------|-------------------|--------------------------------|
| *Pterophyllum scalare* | Dactylogyrus sp.       | Gills          | 35.00             | 1-4                            |
|               | Gyrodactylus sp.       | Skin           | 5.00              | 1-4                            |
|               | Ichthyophthirius multifiliis | Skin         | 15.00             | 1-11                           |
|               | Trichodina reticulata | Skin/Fin       | 25.00             | 1-6                            |
|               | Capillaria sp.         | Intestine      | 22.50             | 1-3                            |
| *Carassius auratus*   | Dactylogyrus sp.       | Gills          | 28.75             | 1-4                            |
|               | Gyrodactylus sp.       | Skin           | 72.50             | 1-8                            |
|               | Ichthyophthirius multifiliis | Skin      | 87.50             | 1-16                           |
|               | Trichodina reticulata | Skin           | 20.00             | 1-14                           |
|               | Lernaea cyprinacea     | Skin/Fin       | 30.00             | 1-3                            |
| *Symphsodon discus*  | Dactylogyrus sp.       | Gills          | 7.50              | 1-2                            |
|               | Gyrodactylus sp.       | Skin           | 13.75             | 1-2                            |
|               | Ichthyophthirius multifiliis | Skin      | 10.00             | 1-8                            |
|               | Trichodina reticulata | Skin/Fin       | 6.25              | 1-4                            |
| *Poecilia latipinna* | Dactylogyrus sp.       | Gills          | 16.25             | 1-2                            |
|               | Gyrodactylus sp.       | Skin           | 28.75             | 1-5                            |
|               | Ichthyophthirius multifiliis | Skin      | 12.50             | 1-4                            |
|               | Trichodina reticulata | Skin/Fin       | 12.50             | 1-7                            |
|               | Capillaria sp.         | Intestine      | 1.25              | 1-2                            |
|               | Lernaea cyprinacea     | Skin/Fin       | 5.00              | 1                              |
| *Poecilia reticulata* | Dactylogyrus sp.       | Gills          | 17.5              | 1-3                            |
|               | Gyrodactylus sp.       | Skin           | 21.25             | 1-2                            |
|               | Ichthyophthirius multifiliis | Skin      | 6.25              | 1-6                            |
|               | Trichodina reticulata | Skin           | 15.00             | 1-9                            |
|               | Capillaria sp.         | Intestine      | 2.50              | 1                              |
|               | Lernaea cyprinacea     | Skin/Fin       | 1.25              | 1-2                            |
Ichthyophthirius multifiliis, Gyrodactylus sp., Dactylogyrus sp., Trichodina spp., Argulus coregoni, A. japonicas, A. foliaceus was reported from C. auratus. Also, I. multifiliis, Dactylogyrus sp., Microsporidian sp. and Ichthyobodo sp. were reported from angelfish in the Mazandaran province.

In this study, I. multifiliis had the highest infection rate in C. auratus. The highest prevalence of Gyrodactylidae and Dactylogyridae were observed in C. auratus and the lowest in P. scalare and S. discus, respectively.

In our study, Capillaria sp. was reported for the first time from P. scalare in Iran. This nematode may cause high mortality in aquarium fishes. Rahmati-holasoo et al. showed that infection with Capillaria sp. could cause a great loss in ornamental fish from Cichlidae in Iran.

It seems that many factors such as water quality, fish density, diet, physiology of host and parasite life cycle may have contributed to the severity and type of these parasites. Given the important role of risk factors, reducing stressful situations through improved management and environmental conditions such as improved water quality and switch on time, reduction of organic matter, avoiding excessive density of fish and unnecessary manipulation and using appropriate disinfectants in farms can be useful to control and reduce economic losses caused by parasitic disease in ornamental fishes.

The identified parasites in this study have not been reported as a parasitic problem in Iran. However, the rate of infection in these aquarium fishes was low. The possibility of transmission of contamination to the native aquarium fishes, even farmed fishes should be taken into consideration.

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