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Pterophyllum scalare (Perciformes: Cichlidae) A New Paratenic Host of *Capillaria* sp. (Nematoda: Capillariidae) in Iran

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Abstract: Aquarium fish trade is a very important sector in all over the world. Angel fish is one of the most popular freshwater fish species in the aquarium trade industry. Fish parasites and their effects have become increasingly visible during the latest decades because of the growth of freshwater ornamental. In this study, 100 apparently healthy angelfish (*Pterophyllum scalare)* was obtained from a local ornamental fish farm in the North of Iran during 2009 to 2010. The external surface, abdominal cavities and digestive tracts were examined for any presence of nematode parasites. In overall, 18 samples were recognized to be infected by nematodes. The range of contamination was between 1-3 nematodes. Number of male nematodes (6%) were less than a number of female nematodes (24%). A high number of free eggs were observed in intestine of fish. Regarding the morphological characteristics of the nematodes and their eggs, they were identified as *Capillaria* sp. This study is the first report of *Capillaria* sp. in *Pterophyllum scalare* in Iran. *Pterophyllum scalare* is one of the most popular freshwater fish species in Iran and might act as paratenic host for *Capillaria* sp. Further studies are required to discover the role of these fish in the transmission of nematodes.

Key words: *Pterophyllum scalare* · *Capillaria* sp. · Paratenic Host

INTRODUCTION

Aquarium fish trade is a very important sector in all over the world. The global trade in ornamental fish, associated aquarium and pond accessories is more than U.S. $ 7×10^9 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 maintained by hobbyists. The biggest portion of the aquarium fish industry is the freshwater aquarium fish sector. Although this worldwide interest in ornamental fish has led to great development in their cultivation techniques, there are still many difficult-to-culture species with high demand. Cultivation and propagation of ornamental fishes have been increased in the last 20 years in Iran. There are 150 species of aquarium fish in Iran and about 40 species are bred and raised in the country [1].

Angel fish is one of the most popular freshwater fish species in the aquarium trade industry [2]. Freshwater angelfish are the most popular tropical aquarium fish due to mixtures of strains and the ease of maintenance. The angelfish is classified in the family of Cichlidae, with a strongly laterally compressed, disc-shaped body and long, elegant fins. Due to its body coloration, shape and economical value the angel fish represents one of the most important ornamental cichlid species [3]. So far, only 4 nominal species of angelfish were recognized; *Pterophyllum scalare*, *P. leopoldi*, *P. dumerilii* and *P. altum* [4]. *Pterophyllun scalare* undoubted is the most popular and generally more available member of the entire family of Cichlidae. Both the silver and a myriad of artificially selected color and finnage varieties are commercially grown [4]. Angelfish is an endemic fish of the Amazon basin. In nature, they are found in soft, acid water that is very warm, usually around 26°C.

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Their natural environment is slow moving water that contains many hiding places such as roots and tall plants. Angelfish usually pairs up and start showing spawning behavior between the ages of 8 and 12 months [5]. When a pair is beginning to form, the two fish may take part in short jaw locking "battles." The pair will choose a spawning site and begin cleaning it with their teeth. The male ovipositor is smaller and more pointed in shape than that of the female. Spawning begins, two or three days after the cleaning commences [5]. The female lays rows of eggs on the spawning site and the male follows her, fertilizing them. When spawning becomes complete, there will usually be several hundred of eggs and may be as many as 1,200 if the pair is mature and in good condition. Any eggs which are infertile will turn white over the first day or two [5]. Ornamental fish pathogens spread very quickly in the world because of their commercial benefits. Consequently, routine infectious disease controls are very important for risk analysis and precaution steps. Fish parasites and their effects have become increasingly visible during the latest decades because of the freshwater ornamental Fish industry developments throughout the world [6]. For this reason, we aimed to isolate and identify external (skin, fins and gills of fish) and internal (intestine of fish) nematode parasites from Angel fish in Iran from 2009 to 2010.

MATERIALS AND METHODS

A total of 100 apparently healthy angelfish (*Pterophyllum scalare*) from 2009 to 2010 were obtained from a local ornamental fish farm in Sari and Golestan provinces in the North region of Iran. The average fish weight was 2.8 g with an average length of 7.4 cm. Live fish were transferred to fish diseases laboratory at the Caspian Sea Ecology Research Center, with aerated water with a portable air pump or plastic bags including ice. The water temperature was 27±2°C, Dissolved Oxygen (DO) was 4.7±0.2 mg L^{-1} and pH was 7.4±0.3. The external surface, abdominal cavities and digestive tracts were examined for any presence of nematode parasites. Dissection and examination of the fish specimens were carried out under a dissecting microscope. The collected nematodes were counted and fixed in 70% ethanol and for examination, they were cleared using glycerine. The photograph was taken with the aid of a microscope that was equipped with micrometers and a Sony camera. Identification of the parasites was carried out using morphometric and morphological criteria [7].

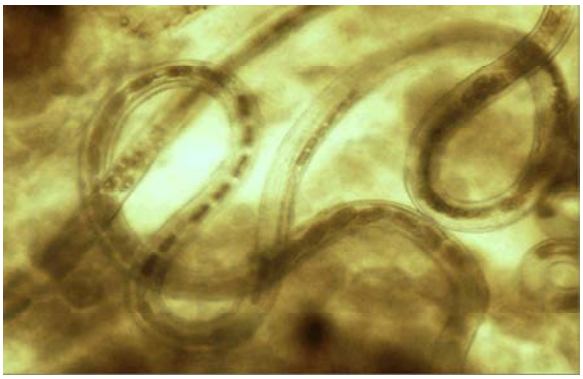

Fig. 1: A female of *Capillaria* sp. (×40).

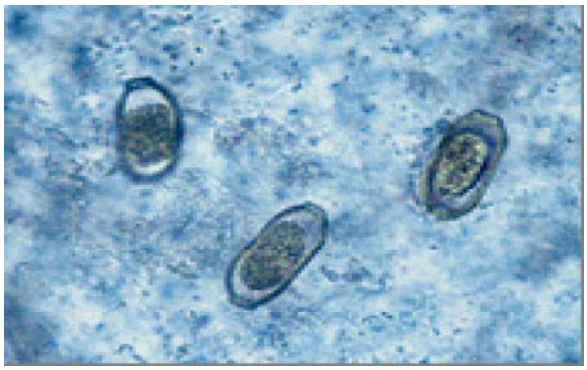

Fig. 2: Barrel-shaped eggs with polar plugs in intestine of *Pterophyllum scalare* (×400).

RESULTS

In general, 18 samples were recognized to be infected by nematodes. The range of contamination in the abdominal cavity was between 1-3 nematodes. No nematode was detected in external surface. Female nematodes had brown barrel-shaped eggs with a plug-like structure on each end (Figs. 1, 2) and male nematodes had spicule. The numbers of male nematodes (6%) were less than the numbers of female nematodes (24%). A high number of free eggs were observed in intestine of fish. Regarding morphological characteristics of the nematodes and their eggs, they were identified as *Capillaria* sp. by Moravec *et al.* [7].

DISCUSSION

Ornamental fish farming is an important primary industry. Aquarium fish constitute an extremely large segment of the pet animal industry [8, 9]. The breeding and rearing of ornamental fish has a special position in the world and plays an important role in exchange income and occupation of some countries. The world business of this

fish which was estimated roughly $900 million, has devoted a remarkable insight into it Meshgi *et al.* [1]. Diseases problem including hazards caused by parasitic organisms are the primary threat to further growth of the industry. Diseases caused by parasites are widespread and could diminish the fish in intensively stocked ponds and aquaria. Parasites imported by ornamental fish may present risks, both to native fish populations and to the aquaculture industry. Fish parasites and their effects have become increasingly visible during the latest decades because of the growth of freshwater ornamental fish industries throughout the world. The debut of a new parasite may cause devastating effects on native fish species, as these may not have evolved appropriate defense mechanisms against foreign organisms.

Nematodes are often regarded as one of the most significant and harmful worm parasites that affect fish. They can kill the host by serious mechanical harm from excessive movement that puts a strain on the host, killing the fish and having a detrimental effect on the fishing industry [10, 11].

Capillarid nematodes are frequent parasites in both freshwater and marine fishes [7]. *Capillaria* species have direct life cycles and can spread from one fish to another by ingestion of infective eggs. It may take *Capillaria pterophylli* eggs up to three weeks at 68-73°F (less time at warmer temperatures) before they contain embryos which are developed enough to be infective when ingested by a fish. The length of infection, the time required for mature adult parasites to produce eggs or larvae, is approximately three months. Capillarid infections can be treated by dewormers such as levamisole or fenbendazole [7].

These nematodes may cause a high mortality in aquarium fishes. For example *Capillaria pterophylli* is known to induce a high mortality in aquarium-kept cichlids, cyprinids and catfish [12]. *Capillaria pterophylli* is a relatively common nematode seen in the intestine of cichlids (including angelfish and discus). *Capillaria* species are also seen in cyprinids, gouramis, tetras and other species of fish.

Different parasite species were reported from various ornamental fish species. *Tetrahymena* sp. from *Carnegiella strigata*, *Piscinoodinium pilullare* from *Carnegiella martae, Trichodinids* spp. from *Carnegiella strigata*, *Carnegiella*. *martae* and *Nannostomus*, *Procamallanus* sp. from *Paracheirodon axelrodi* [13]. *Gyrodactylus kattharineri* and *Gyrodactylus carassii* from *Carassius carassius* [14]. *Ichthyobodo* sp., *Ichthyophthirius multifiliis*, *Chilodonella* sp., *Trichodina* spp., *Dactylogyrus extensus*, *Gyrodactylus bullatarudis*, *Lernaea cyprinacea*, *Argulus foliaceus*, *Argulus japonicus* and *Capillaria* sp. from gold fish, guppy and cichlids [15], *Ambiphyra* spp. from guppy [16] and *Oodinium pillularis* from *Poecilidae* [17] Jeong-Ho *et al.* [18]; in Sri Lanka had reported *Camallanus cotti* in *Poecilia reticulata*, that cause a high mortality in cultured fish.

There is some information about parasites of ornamental fish in Iran: *Dactylogyrus rotator*, *Chiloldonella* sp., *Hexamita* sp., *Ictyobodo necator*, *Ichthyophtirius multifilis*, Microsporidium, *Myxosporida* sp. *Tricodina* sp. and *Lernaea cyprinicea* were reported in ornamental fish by Meshgi *et al.* [1]; *Ichyophthirius multifiliis, Gyrodactylus* sp, *Dactylogyrus* sp*, Trichodina* spp, *Argulus coregoni*, *Argulus japonicas*, *Argulus foliaceus* from *Carassius auratus* [19]. *Ichyophthirius multifiliis, Dactylogyrus* sp*, Microsporidian* sp and *Ichthyobodo* sp. from angelfish were reported in the Sari province by Taherpour *et al.* [20]. Results of the study of Rahmati-holasoo *et al*. [21]; showed that infection with some species of *Capillaria* could cause a great loss in ornamental fish from cichlidae in Iran. In one study on parasites of ornamental fish in Brazil, *Capillaria* sp. and *Contracaecum* sp. were reported from *Moenkhausia sanctaefilomenae* [13]. Also. *Capillaria* sp. was reported from discus, guppy (*Poecilia reticulata*) and angel (*Pterophyllum scalare*) in Turkey and Sri Lanka respectively [22, 23].

There are few studies on nematode parasites that infect aquarium fish in the world. In order to improve aquarium fish trade in Iran and also the prevention of the losses of fish stock, more information on the parasite fauna that affects aquarium fish and may be transferred to farms, is needed.

In the last decade, different ornamental fish farms in Iran have bred, rearing and importing aquarium fish and their number is increasing. One of the most important ways in transmission of parasitic infestations is importation of fish from countries which are infested by these parasites. A large number of different species of ornamental fish including different kinds of angelfish are imported annually from Southeast Asian countries to Iran. Uncontrolled importation of live fish can lead to transmission of *Capillaria* and other parasites to the native fish and cause economic loss. Likewise, their transmission can due to serious environmental losses to valuable native fish. Because of the societal and economic importance of the ornamental fishing industry, it is

necessary to improve capture practices, from the stage of handling and maintenance of fish in the field, to their dispatch by exporters. Therefore, monitoring of the health status of ornamental fish needs to be one of the most significant activities in exportation holding facilities; because any ornamental fish trade operation without adequate sanity practices will contribute to significant economic losses for the exporter, as well as possessing a negative influence on exportation. Therefore, the introduction of transmissible parasites may cause severe disease outbreaks among the imported fish, thereby compromising the exportation industry.

CONCLUSION

This study is the first report of *Capillaria* sp. in *Pterophyllum scalare* in Iran. Since, *Pterophyllum scalare* is one of the most popular freshwater fish species in Iran and may act as paratenic host for *Capillaria* sp. Further studies are seemed essential to mention the involvement of this fish in the transmission of nematodes.

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