

A Parasitological Examination on Aquarium Fish Sold in Petshops in Kırıkkale

Kırıkkale'deki Petshoplarda Satışa Sunulan Akvaryum Balıklarında Parazitolojik İncelemeler

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ABSTRACT

Objective: The aim of the present study was to determine the prevalence of parasitic infections in aquarium fish sold in local pet shops.

Methods: Totally 502 fish samples from 8 species were obtained from 7 pet shops. Native preparations were prepared from the gills, fins, skin, intestines, and internal organs of fish and examined under a light microscope.

Results: It was detected at the end of the study that 62.7% of the fishes examined were infected with one or more parasite species. Among the fish examined, 28.9% were infected with a single parasite, whereas 33.9% were infected with mixed parasites. *Chilodonella* sp. identified as the most common species. Other species detected included *Trichodina* sp., *Piscinoodinium* sp., *Ichthyobodo* sp., *Ichthyophthirius multifiliis*, *Apiosoma* sp., *Epistylis* sp., *Vorticella* sp., *Gyrodactylus* sp., *Dactylogyrus* sp., *Capillaria* sp., *Camallanus* sp., metacercariae, and nematode larvae, *Argulus* sp., *Philodina* sp., *Euchlanis* sp., *Aelosoma* sp., and *Tetrahymena*.

Conclusion: The importance of the present study is that highest number of parasite species were detected in aquarium fish sold in pet shops in Türkiye. The aquarium owners should pay attention to the cleanliness of the aquarium water in order to reduce the rate of parasitic infection in fish; when new fish are purchased, they should be taken from reliable sources, and the quarantine process should be observed.

Keywords: Aquarium, arthropods, fish, helminths, protozoa

ÖZ

Amaç: Bu çalışmanın amacı yerel petshoplarda satışa sunulan akvaryum balıklarında paraziter enfeksiyonların yaygınlığının belirlenmesidir.

Yöntemler: Yedi petshoptan, 8 türe ait 502 adet balık örneği alınmıştır. Balıkların solungaç, yüzgeç, deri, bağırsak ve iç organlarından natif preparatlar hazırlanarak ışık mikroskobu altında incelenmiştir.

Bulgular: Çalışma sonunda incelenen balıkların %62,7'si bir veya birden fazla parazit türü ile enfekte bulunmuştur. Balıkların %28,9'unda tek, %33,9'unda birden fazla paraziter etken tespit edilmiştir. *Chilodonella* sp. en yaygın tür olarak belirlenmiştir. Tespit edilen diğer türler *Trichodina* sp., *Piscinoodinium* sp., *Ichthyobodo* sp., *Ichthyophthirius multifiliis*, *Apiosoma* sp., *Epistylis* sp., *Vorticella* sp., *Gyrodactylus* sp., *Dactylogyrus* sp., *Capillaria* sp., *Camallanus* sp., metaserkerler ve nematod larvaları, *Argulus* sp., *Philodina* sp., *Euchlanis* sp., *Aelosoma* sp., *Tetrahymena* sp.'dir.

Sonuç: Bu çalışma Türkiye'de petshoplarda satılan akvaryum balıklarında en fazla parazit türünün tespit edildiği çalışma olması bakımından önemlidir. Balıklarda paraziter enfeksiyon oranını azaltmak için akvaryum sahipleri akvaryum suyunun temizliğine özen göstermeli, yeni balık alındığında güvenilir kaynaklardan alınmalı ve karantina sürecine dikkat edilmelidir.

Anahtar Kelimeler: Akvaryum, arthropod, balık, helmint, protozoon

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INTRODUCTION

In recent years, there has been a rapid increase in aquarium fish farming in Türkiye, and it has become an important business line. There are many enterprises that breed or sell aquarium fish in each province of Türkiye. However, people raise aquarium fish as ornamental animals in their homes and workplaces.

Parasitic diseases may spread rapidly among aquarium fish and cause significant economic losses if necessary precautions are not taken (1). There are limited number of studies on determination of parasites in aquarium fish in Türkiye. *Chilodonella* sp., *Trichodina* sp., *Ichthyophthirius multifiliis*, *Ichthyobodo* sp., *Hexamita* sp., *Myxosporidia* sp., *Dactylogyrus* sp., *Gyrodactylus* sp., *Thaparocleidus* sp., *Centrocestus metaserkeri*, *Lernaea* sp., *Argulus* sp., *Camallanus* sp., *Capillaria* sp., *Ambiphyra* sp., *Epistylis* sp., *Tetrahymena*, *Vorticella*, *Philodina*, *Chaetonotus* sp., *Euchlanis* sp., (2), *Acanthocephala* sp., *Sciadicleithrum variabilum* (3) species were detected in aforesaid studies (4-11).

The aim of the present study was to determine the prevalence of parasitic infections in aquarium fish sold in local pet shops.

METHODS

The fish samples used in the study were collected from pet shops located in Kırıkkale. Approvals for the collection of samples and the carrying out the study were obtained from Kırıkkale University Animal Experiments Local Ethics Committee (E-608221397-010.99-74220 letter). Fish samples were taken with the approval of the pet shop owner. Petshops were visited on a daily basis, and the dead fish in the aquariums were duly delivered to Kırıkkale University Faculty of Veterinary Medicine, Routine and Epidemiology Laboratory in separate containers. Totally

502 dead fish were collected from 7 pet shops during the study period. Such dead fish belonged to goldfish (*Carassius auratus*), Lepistes (*Poecilia reticulata*), angelfish (*Pterophyllum scalare*), Beta fish (*Betta splendens*), stringray fish (*Hypostomus* sp.), molly fish (*Poecilia sphenops*), neon tetra fish (*Paracheirodon innesi*) and cichlid fish (Cichlidae) species.

The preparations were prepared by taking scrapings from the gills, fins, skin, intestines, and internal organs, separately through a slide from the fish delivered to the laboratory on the same day. The preparations were examined under the light microscope and identified at the genus level using the relevant literature, which was positive for parasites (12,13).

Statistical Analysis

All data were analyzed with frequency table. SPSS (IBM SPSS for Windows ver. 22) statistical package program was used for analysis. Infection rates are calculated as a percentage.

RESULTS

Among 502 fish examined during the study, 62.7% of these fish were found infected at least with one parasite types. Totally 19 parasite species were detected in these fish. Other species detected were protozoans including *Chilodonella* sp., *Trichodina* sp., *Piscinoodinium* sp., *Ichthyobodo* sp., *I. multifiliis*, *Apiosoma* sp., *Epistylis* sp., *Vorticella* sp.; helminths including *Gyrodactylus* sp., *Dactylogyrus* sp., *Capillaria* sp., *Camallanus* sp.; metacercariae, and nematode larvae; arthropods including *Argulus* sp., Rotifera including *Philodina* sp., *Euchlanis* sp., annelidae including *Aelosoma* sp., and a free-living ciliata, *Tetrahymena* sp. (Table 1).

The fish which were infected with a single parasite was 28.9% of the fish examined and 46% of the fish that were positive for

Table 1. Parasites detected in aquarium fish and their rates

Parasite	Number of infected fish	Ratio of positive samples to the number of fish examined (%)	Ratio of parasite species in positive fish (%)
<i>Chilodonella</i> sp.	192	38.2	61.0
<i>Trichodina</i> sp.	83	16.5	26.3
<i>Gyrodactylus</i> sp.	73	14.5	23.2
<i>Dactylogyrus</i> sp.	69	13.7	21.9
<i>Piscinoodinium</i> sp.	44	8.8	14.0
<i>Ichthyobodo</i> sp.	42	8.4	13.3
<i>I. multifiliis</i>	4	0.8	1.3
<i>Capillaria</i> sp.	2	0.4	0.6
<i>Camallanus</i> sp.	1	0.2	0.3
<i>Apiosoma</i> sp.	5	1	1.6
<i>Vorticella</i> sp.	1	0.2	0.3
<i>Philodina</i> sp.	64	12.7	20.3
<i>Euchlanis</i> sp.	23	4.6	7.3
<i>Argulus</i> sp.	1	0.2	0.3
<i>Tetrahymena</i> sp.	5	1	1.6
Metacercaria	4	0.8	1.3
Nematode larvae	7	1.4	2.2
<i>Aelosoma</i> sp.	2	0.4	0.6
<i>Epistylis</i> sp.	1	0.2	0.3

parasites. Among the fish samples, 18.3% were found infected with two parasite types, 7.0% were found infected with three parasite types, 5.4% were found infected with four parasites, 2.8% were found infected with five parasites, and 0.4% were found infected with six parasites. Majority of the fish that were positive for the parasite were infected with a single agent (Table 2).

Chilodonella sp., *Trichodina* sp., *Piscinoodinium* sp., *Ichthyobodo* sp., *Ichthyophthirius multifiliis*, *Gyrodactylus* sp., *Dactylogyrus* sp., Nematoda larvae, metacercaria, *Vorticella* sp., *Philodina* sp., *Euchlanis* sp., and *Aelosoma* sp. were detected from gill samples; *Trichodina* sp., *Piscinoodinium* sp., *Chilodonella* sp., *Capillaria* sp., *Camallanus* sp., and nematod larvae from viscera and intestinal samples; *Chilodonella* sp., *Trichodina* sp., *Piscinoodinium* sp., *Ichthyobodo* sp., *I. multifiliis*, *Apiosoma* sp., *Epistylis* sp., *Gyrodactylus* sp., *Dactylogyrus* sp., *Argulus* sp., *Philodina* sp., *Euchlanis* sp., *Tetrahymena* sp. from skin scratches were detected (Figure 1).

DISCUSSION

Aquarium and aquarium fishing has become a hobby for people today and a sector where significant gains are made commercially. Therefore, the number of studies on aquarium fish breeding and diseases is increasing in many parts of the world as well as

Türkiye. Parasitic diseases are the diseases that are emphasized a lot because they may spread in a short time in aquarium fish and cause symptoms that may lead to the death of the fish.

Studies have been carried out on parasites of aquarium fish in different parts of the world in recent years. The presence of parasites at different rates was determined in those studies. The rate of parasitic infection was found between 43.3 and 90.90% in studies conducted on aquarium fish in Türkiye (4,9). The rate of parasitic infection in ornamental fish was found between 69.1% and 100% (14,15) in Pakistan, 22.5% (16) in Brazil, and between 26.33% and 95.0% in Iran (17,18). At least one parasite species was found in 62.7% of the aquarium fish examined in our study. This rate is between the rates in studies conducted in Türkiye and in different regions of the world. Different results between studies may depend on many factors, including the number and type of fish examined, the maintenance conditions of aquariums and ornamental ponds, the administration of antiparasitic treatment, and the cleanliness of the aquarium water.

The rate of *Chilodonella* sp. was found between 26% and 51% in studies conducted in different regions (19-21). *Chilodonella* sp. was found in scratched skin samples collected from the gills, fins and scales of all fish species examined in this study. The rate of

Table 2. Parasite infection rates detected in aquarium fish

	Positive						Negative
	Only	Mix					
	One parasite	Two parasite	Three parasite	Four parasite	Five parasite	Six parasite	
No	145	92	35	27	14	2	187
In positive fish (%)	46.0%	29.2%	11.1%	8.6%	4.4%	0.6%	0%
In all fish (%)	28.9%	18.3%	7.0%	5.4%	2.8%	0.4%	37.3%
Total	145 (28.9%)		170 (33.9%)				187 (37.3%)
	315 (62.7%)						187 (37.3%)

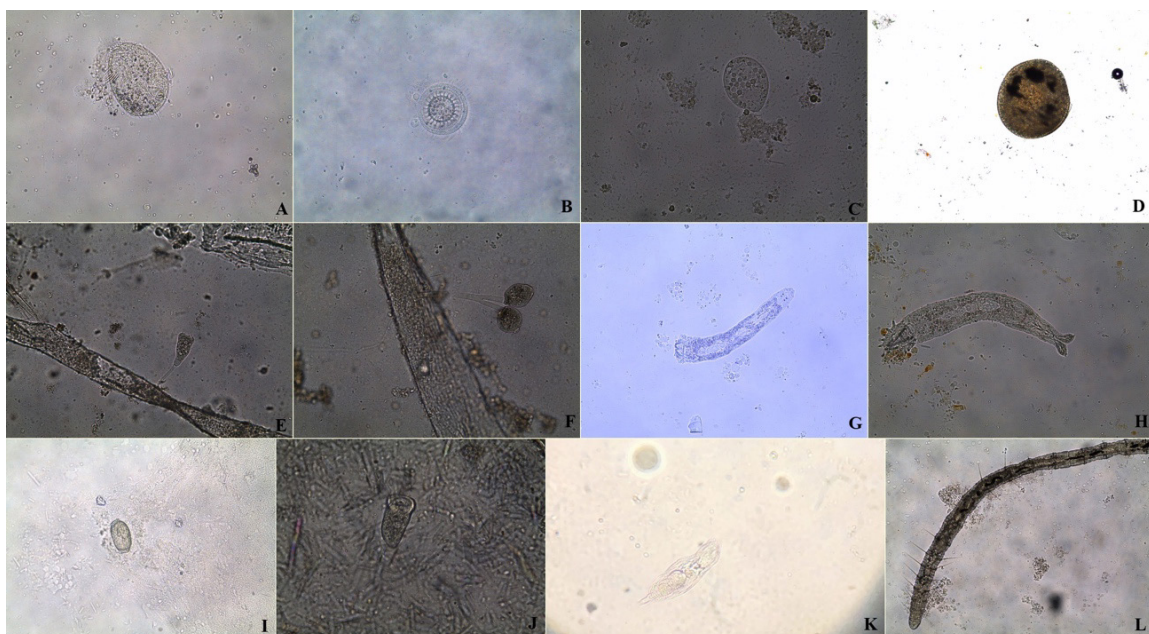


Figure 1. Some parasites species detected in examined fish, A: *Chilodonella* sp., B: *Trichodina* sp., C: *Piscinoodinium* sp., D: *I. multifiliis* E: *Apiosoma* sp., F: *Epistylis* sp., G: *Dactylogyrus* sp., H: *Gyrodactylus* sp., I: *Capillaria* sp. egg, J: *Philodina* sp., K: *Euchlanis* sp., L: *Aelosoma* sp.

Chilodonella sp. was determined as 38.2%. Such rate is similar to those obtained in previous studies. The most common parasite detected in this study was *Chilodonella* sp.

Trichodina sp. are protozoan parasites which are common in aquarium and ornamental fish. Studies conducted globally detected a rate between 3% and 26.6% (4,20,21). *Trichodina* sp. was found in gill, skin scraping, and visceral samples of our study. The rate of *Trichodina* sp. detected in this study was 16.5%. Such rate is similar to those obtained in previous studies conducted on ornamental fish.

Ichthyophthirius multifiliis is one of the protozoan parasites with the highest distribution in the world (18). In our study, the rate of *I. multifiliis* was determined as 0.8%. The rate of *I. multifiliis* was reported between 2.8% and 8% in previous studies in Türkiye and the world (4,21). The reason for lower rates detected in our study when compared to previous studies may be due to the fact that the factor is well known by the producers and that protective measures are taken for it.

The rate of *Piscinoodinium* sp. was reported as 8.8% in this study. The presence of this parasite including *Oodinium* and *Piscinoodinium* has been reported in aquarium and ornamental fish. It has been reported that 6% of *Piscinoodinium* is observed on the gills of guppy fish in the Medan region of Indonesia (22). Kayis et al. (9) reported that they detected *P. pillulare* on the skin of Beta fish for the first time in Türkiye. Florindo et al. (23) reported that the most common species in all farms was *P. pillulare* when they examined the ornamental fish from different breeding farms in Brazil. Furthermore, it has been reported with a rate of 16.7% in goldfish in Brazil (24). The reason for the higher prevalence of *Piscinoodinium* sp. in this study may be associated with the poor maintenance conditions of one of the pet shops and the higher rate of *Piscinoodinium* in the samples collected from this pet shop. Ichthyobodosis which is caused by severe infections of the skin and gills of parasitic flagellates of the genus *Ichthyobodo* is an important parasitic disease that causes serious losses among ornamental and farmed fish worldwide (25). The rate of *Ichthyobodo* (*Costia*) sp. was found between 1.7% and 27.6% in studies conducted to date (9,19-21,26); however, it was found 8.4% in this study. The rate in our study is similar to previous studies.

Apiosoma species are resident ciliates that cause infection when present in large numbers, are located on the gills, skin and fins of fish, and are commonly detected in fish grown in ponds (27). The rate was detected 1% in our study. It has been reported that it is detected in 6% of goldfish in Brazil (24). It has been reported on the skin of aquarium fish in the Rize region of Türkiye (28). In our study, the parasite was found in samples collected from both gills and skin, and fins.

The *Epistylis* is a pedicellate ciliate that attaches to the skin or fins of the host (27). It has been detected in 100% of skin scrapings of goldfish in Brazil. However, it has been reported that no causative agent was found in the gills (24). Kayis et al. (9) reported that the agent was found in gill and skin scrapings; Iqbal and Haroon (14) reported that they were found only in gills. The rate of the parasite found in the scraping preparation taken from the skin and fins was 0.2%.

Vorticella sp., a ciliate from the Ciliophora branch, has been detected in several studies conducted in Türkiye (2,10,21). The rate of *Vorticella* sp. in a study conducted in Tetra and stingray

fish in Konya was found 1% (21) in average, and 2% in tetra fish. Isik et al. (10) reported that *Vorticella* sp. was detected on only the gills of discus fish. Bulguroğlu (2) reported that *Vorticella* sp. was detected on the skin of yellow princess, blue princess, ahli cichlid, velifera and white mole fish. In this study, *Vorticella* sp. was found in a gill sample of a fish.

Tetrahymena sp. is considered an important pathogen of ornamental fish and causes significant death in these fish. These parasites are known as guppy disease because they cause infection, especially in guppy fish; however, their presence was detected in different ornamental fish species other than guppies. *Tetrahymena* sp. was detected on the gill and skin of 7 discus fish examined in Konya province of Türkiye (10). It was found at a rate of 11 (21) in tetra fish in another study conducted in the same shade. The rate of *Tetrahymena* was reported 1% in the aforesaid study. The cause for that may be due to the different fish species studied and the low rate of guppies.

It is noted that the most common monogenean trematodes are *Gyrodactylus* sp. and *Dactylogyrus* sp. species. In studies carried up to date, the rate of *Gyrodactylus* sp. was detected between 1% and 40% (4,19-22,29), and *Dactylogyrus* sp. was detected between 1% and 28% (4,19-22,29). Such rates were 14.5% and 13.7%, respectively in this study. *Dactylogyrus* and *Gyrodactylus* species may spread rapidly among aquarium fish under stressful situations. Therefore, it is expected to be more common in poor care conditions, transportation, and situations that may cause stress. The reason for the different rates between studies unequal conditions in all aquariums.

Capillaria sp. is one of the most common nematode parasites of aquarium fish. The rate was reported 0.9% (4) in previous studies conducted in Türkiye. Dewi et al. (22) detected in the abdominal cavities of guppy and goldfish as 8% and 4%, respectively, in Indonesia. In a study conducted in Iran, *Capillaria* sp. rate was reported as 0.33% in aquarium fish (18). Adult female parasite and *Capillaria* sp. egg were detected in 2 (0.4%) of 502 fish examined in our study. The rate of *Capillaria* sp. detected in our study is similar to the studies conducted in Ankara and Iran.

The rate of *Camallanus* sp. was detected as 0.4% (4) in Türkiye. However, it was reported that *Camallanus* was detected in a guppy fish in Afyon (30). It was reported in Brazil that adult *C. cotti* (31) parasites were found in guppy and beta fish, and adult *C. maculatus* parasite in plati fish (32). In this study, adult *Camallanus* sp. was found in the gut of one fish (0.2%).

Aeolosoma sp. is a freshwater annelid. The causative agent was found in the gill samples of two (0.4%) fish examined in this study. In a previous study conducted in the Konya region on total tetra and stingray fish, it was found only in one stingray fish with a rate of 1% (21). It was considered that the different number and species of fish examined may have caused these rates to differ from each other.

Whether rotifers are true parasites are debatable. It was reported in studies conducted on aquarium and ornamental fish that rotifera were rarely detected. In this study, the rate of *Euchlanis* sp. was 4.6%, whereas the rate of *Philodina* sp. was found 12.7%. *Euchlanis* sp. and *Philodina* sp. were found in gill and skin samples. *Philodina* species were previously found in the gills of discus fish in Türkiye (10). *Euchlanis* sp. was reported as 5% in the study conducted on tetra and stingray fish (21). The rate of *Euchlanis* sp. was found similar to previous studies. However, *Philodina* sp. was detected higher than previous studies. The reason for that was

thought to be the cleanliness of the aquarium water and the poor maintenance conditions.

Argulus sp. is known as fish lice. It parasitizes on both marine and freshwater fish, and it is an arthropod that may cause infestations with higher morbidity and mortality under severe infections. The presence of *A. japonicus* species was reported in three goldfish in Texas (33). It was reported that *A. foliaceus* was found in the same fish species in Iran (34) and Pakistan (14). It was reported that *A. foliaceus* species was found in the skin and gills of an astronaut fish (*Astronotus ocellatus*) (7), *A. japonicus* species was found in 33% (35) koi fish and 28% in telescope fish (36) in Türkiye. One adult *Argulus* sp. was detected in only one (0.2%) of 502 fish samples examined in our study. It was considered in our study that the reason for the low incidence of the agent was recognition of the agent by the aquarium owners because they could see it macroscopically and started to struggle as soon as they saw it.

In our study, at least one and at most 6 different parasite species were found on the infected fish. It was determined that most of the fish that were positive for parasites were infected with a single parasite species (28.9%). This was followed by the fish infected with two (18.3%), three (7.0%), four (5.4%), five (2.8%), and six (0.4%) different parasite species. Doganay et al. (4) reported in their study conducted in Ankara that there were fish infected with at most 5 species at the same time, and they also reported that the fish they examined were generally infected with a single species (21.4%). Moyses et al. (24) reported in their study on goldfish in Brazil that 30% (9/30) of the fish had 2 or 3 parasite species, 40% (12/30) had 4 parasite species, and 30% (9/30) 5 had multiple infestations in the gills and/or skin, with one or more parasite species.

CONCLUSION

Consequently, the rate of parasitic infection was found higher in the fish examined in our study. The aquarium owners should pay attention to the cleanliness of the aquarium water in order to reduce the rate of parasitic infection in fish; when new fish are purchased, they should be taken from reliable sources, and the quarantine process should be observed.

* Ethics

Ethics Committee Approval: Approvals for the collection of samples and the carrying out of the study were obtained from Kırıkkale University Animal Experiments Local Ethics Committee (E-608221397-010.99-74220 letter).

Informed Consent: A patient consent form is not required as the study was conducted on dead or dying fish.

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* Authorship Contributions

Surgical and Medical Practices: S.G., G.N.A., S.A., Concept: S.G., G.N.A., S.A., Design: S.G., G.N.A., S.A., Data Collection or Processing: S.G., G.N.A., S.A., Analysis or Interpretation: S.G., G.N.A., S.A., Literature Search: S.G., G.N.A., S.A., Writing: S.G.

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