Identification and Prevalence of Parasite Types in Various Freshwater Ornamental Fish in Jakarta

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Abstract. Freshwater ornamental fish are one of the fishery commodities with economic value. Freshwater ornamental fish have high prices, thereby fish farmer can open business opportunities that quite profitable. Therefore, it is necessary to maintain the health of the fish. This study aimed to identify parasites and measure the prevalence of infection of freshwater ornamental fish in Jakarta. The research was conducted at the Animal Physiology Laboratory of Universitas Negeri Jakarta and the Laboratory of Fish Quarantine Quality Control and Fishery Product Safety Jakarta II. The samples consisted of black tetra (*Gymnocorymbus ternetzi*), koi (*Cyprinus rubrofuscus*), goldfish (*Carassius auratus*), manfish/angelfish (*Pterophyllum scalare*), and patin (*Pangasianodon hypophthalmus*) obtained through simple random sampling from the Jatinegara market and the Laboratory of Fish Quarantine Quality Control and Fishery Product Safety Jakarta II. Twenty samples were taken from each fish species, totaling 100 freshwater ornamental fish. The study identified parasites in the freshwater ornamental fish, including *Dactylogyrus sp*., *Gyrodactylus sp.*, and *Trichodina sp.* The highest prevalence of *Dactylogyrus sp.* was found in koi and angelfish, with a prevalence rate of 65%. The highest prevalence of *Gyrodactylus sp.* was found in koi (*Cyprinus rubrofuscus*) with a prevalence rate of 15%. The highest prevalence of *Trichodina sp.* was found in goldfish with a prevalence rate of 45%. Therefore, this study shows that freshwater ornamental fish have identifiable parasites with varying prevalence rates.

Keywords: *Dactylogyrus sp*., Freshwater ornamental fish, Fish parasites, *Gyrodactylus sp*., Prevalence, *Trichodina sp*.

1 Introduction

Indonesia is a country rich in biodiversity, especially the ornamental fish sector, with around 700 species in marine waters and 450 species in fresh waters. This makes Indonesia become one of the largest ornamental fish trade center in the world and included the top five ornamental fish exporting countries, along with the Czech Republic,

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Thailand, Japan and Singapore (Astuti *et al*., 2023). Indonesian freshwater ornamental fish commodities have an export value of around 40.9% which has been advertised globally.

The large business potential of the popularity of freshwater ornamental fish has encouraged many people to get involved in cultivating freshwater ornamental fish. The large demand from local and international markets opens upbusiness opportunities that profitable. Ornamental fish farmers, from small to large scale, utilize increasingly sophisticated technology and breeding methods to increase the quality and quantity of production. Parasitic disesases in freshwater ornamental fish is one of the main problem for farmer and aquarist because it decrease fish production (Putri & Haditomo, 2016). Infectious disease caused by foreign organisms that can damage the metabolic processes of the fish.

Fish, as aquatic creatures, have a tendency to easily become infected with disease. Infections in fish can be triggered by various pathogenic agents, including bacteria, viruses, parasites and fungi. Handayani (2020) states that one type of common infectious disease in fish is parasites. Parasites as organisms that live in the host's body, gain benefits by taking nutrients that the host should use for their body's metabolism (Nurcahyo, 2018). There are two categories of parasites based on their location on the host. Endoparasites are a type of parasite that live inside the host's body, while ectoparasites are parasites that live outside the host's body (Nofyan *et al*., 2015). Both can have a detrimental impact on fish growth.

Fish infected with endoparasites will disrupt their metabolic system, more susceptible to infection with other pathogenic agents. Irritation also often occurs cause organ's damage such as stomach and intestines. Therefore, fish decrease in appetite, followed by a gradual decrease in energy which can ultimately cause death (Afrianto *et al*., 2015).

According to Alifuddin *et al*., 2003, in their research entitled "Parasites in Freshwater Ornamental Fish" shown that the types of ectoparasites found in freshwater ornamental fish include *Trichodina sp.* (Ciliophora), *Gyrodactylus sp.*, *Dactylogyrus sp.* (Platyhelminthes), and *Lernaea sp.*(Crustacean). This type of ectoparasite is similar to research conducted by Azmi *et al.* 2013 found 5 types of ectoparasites on 5 types of Koi (*Cyprinus carpio* L) such as *Trichodina sp*., *Dactylogyrus sp.*, *Gyrodactylus sp.*, *Argulus sp.* and *Myxobolus sp*. The clinical symptoms that can be observed in fish infected with ectoparasites, in general the fish will experience skin wounds, changes in skin color, white spots on the fins and tail, and excessive mucus production. Irritation of the fish's skin can result in loss of scales, damage to the tail fin, and weakness in the fish's movement. Severe infections can also cause anorexia in fish (Pujiastuti & Setiati, 2015).

Therefore, examining the types of parasites in freshwater ornamental fish is important to determine the clinical symptoms of infected fish and the causal factors, so that they can be used as a guide for dealing with them. In addition, calculating prevalence rates is also important because it helps in understanding how common infections occur in fish populations and allows for more effective preventative and treatment measures. The research we carried out aimed to identify types of parasites and measure the prevalence of infection in freshwater ornamental fish in Jakarta.

2 Research Methods

The tools and materials used in this research were fish samples, distilled water, digital microscope, dino eye camera, object glass, digital scales, scalpel, surgical scissors, surgical board, tweezers and measuring tape. The research method used is descriptive. Samples were Black Tetra (*Gymnocorymbus ternetzi*), Koi (*Cyprinus rubrofuscus*), Goldfish (*Carassius auratus*), Angel Fish (*Pterophyllum scalare*), Patin (*Pangasianodon hypophthalmus*) were taken using simple random sampling from the Jatinegara ornamental fish market and from Fish Quarantine Laboratory, Quality Control and Safety of Fishery Products, Jakarta II. Some of the fish examined from the Jakarta II Fishery Product Quality and Safety Control Fish Quarantine Laboratory for this research did not come from company requests or were not target tests for parasite examination. 20 samples were taken for each fish species so that the total of freshwater ornamental fish was 100. Organ samples in the gills, mucus and fins were examined using a digital microscope connected to a dino eye camera.

3 Results and Discussion

Several samples of ornamental fish have been examined in the research, including black tetra (*Gymnocorymbus ternetzi*), koi (C*yprinus rubrofuscus*), goldfish (*Carassius auratus*), angel fish (*Pterophyllum scalare*), Patin (*Pangasianodon hypophthalmus*). The Samples taken for this research came from the Jakarta fish market and the Jakarta II Fish Quarantine Laboratory for Quality Control and Safety of Fishery Products, which was not a request from the company or was not a target test for parasite inspection. Result of parasites identification are given in Table 1.

Table 1. Results of parasite identification in freshwater ornamental fish.

Phylum	Types of parasites	Types of fish	The organ that is attacked
Protozoa	*Trichodina* sp.	Koi *(Cyprinus rubrofuscus)*	Gills, body mucus, and fins
		Goldfish (*Carassius auratus)*	Gills, body mucus, and fins
		Angel Fish /Manfish (*Pterophyllum scalare)*	Body mucus and fins
		Patin fish (*Pangasianodon hypophthalmus)*	Gills and body mucus

Platyhelminthes	*Dactylogyrus* sp.	Black tetra (*Gymnocorymbus ternetzi)*	Gills
		Koi *(Cyprinus rubrofuscus)*	Gills
		Goldfish (*Carassius auratus)*	Gills
		Angel Fish /Manfish (*Pterophyllum scalare)*	Gills and fins
		Patin fish (*Pangasianodon hypophthalmus)*	Gills
	Gyrodactylus sp.	Goldfish (*Carassius auratus)*	Gills and body mucus
		Koi *(Cyprinus rubrofuscus)*	Gills and body mucus
		Patin fish (*Pangasianodon hypophthalmus)*	Gills

3.1 Identification of Parasites in Freshwater Ornamental Fish

Dactylogyrus sp.

Dactylogyrus sp. is an ectoparasite in the form of a Monogenea class flatworm that attacks freshwater and marine fish. Based on observations made, this parasite was found in all fish species studied. This parasite is found in the mucous parts of the body, fins, and is more often found in the gills. This is in accordance with the statement (Pujiastuti & Setiati, 2015) that *Dactylogyrus sp.* almost found on the entire surface of the body and gills. Some are found in fish gills, which are the most important organs for respiration. *Dactylogyrus sp.* found in freshwater ornamental fish shown in Figure 1.

Morphology of the parasite *Dactylogyrus sp.* is a flat-shaped worm measuring 0.1 – 0.5 mm. The head has 4 lobes with two pairs of eyes located in the pharynx area at the anterior end, which functions as a digestive organ. Sucker as an attachment to its host located near the anterior end. At the posterior end of the body there is an attachment device consisting of 2 large hooks (anchors) surrounded by 14 smaller hooks called Opisthaptor (Wahyuni *et al*., 2017). When compared with the parasite *Gyrodactylus sp.*, the parasite *Dactylogyrus sp.* has a haptor consisting of two side protrusions with hooks and a pair of anchors with anchor roots. Meanwhile, *Gyrodactylus sp.* has a haptor consisting of a pair of anchors, but has no hooks or side protrusions (Cone, 1995).

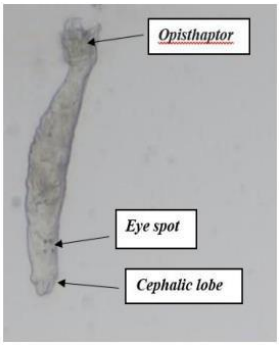

Fig. 1. *Dactylogyrus sp*. (Magnification 100x)
(Personal Documentation, 2024)

Dactylogyrus sp. parasite are hermaphroditic, reproduce by laying eggs with most of the eggs detached from the gills and a small portion embedded in the gills. The size of the egg is 50 um, the shape is ovoid and spinous. The development of this parasite is very fast in waters, the eggs which hatch in the waters become larvae, which swim using cilia called oncomiracidium to search for the gills of a suitable definitive host (fish) and develop to become infective in the fish (Rohde, 2005). The larvae of this parasite can live without a host for 1 day.

The disease caused by this parasite is known as Dactylogiriasis. Based on observations, fish infected with this parasite experience damage to their gills and have difficulty closing the gill covers. This is because the gill lamella epithelium experiences an increase in abnormal cell growth. The production of mucus (mucosa) in infected fish also increases excessively due to parasitic infection, which inhibits the fish's respiratory process (Saputra *et al*., 2022). In fish infected with this parasite in significant numbers the blood vessels in the gill lamellae experience abnormal expansion. The gills may change color to pale. As a result, the fish will experience weight loss due to loss of appetite. Fish that are seriously infected will show unnatural behavior and can result in death (Hasnidar, 2021).

Gyrodactylus sp.

Based on observations made, the parasite *Gyrodactylus sp*. was found. in koi and patin species. This parasite has been found in the gills and mucus of koi and in the gills of patin, which is in accordance with the statement from Kabata (1985) in Manurung *et al*., (2016), which suggests that monogenean parasites are parasites that mostly attack external parts of the fish's body (ectoparasites) such as gills and skin. *Gyrodactylus sp*. is a fish parasitic worm that attaches to the body of the host (fish). This parasite has a morphology similar to *Dactylogyrus sp*., but this parasite does not have eyespots, and has two lobes that protrude at the anterior. Monogenea are flatworms with a length of 0.15-20 mm, their body shape is fusiform, they have a prohaptor in the posterior and a pair of central hook cycles and a number of marginal hooks (Putri *et al*., 2018).

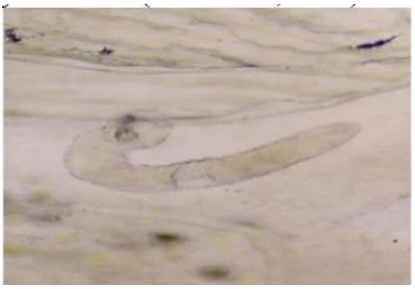

Fig. 2. *Gyrodactylus sp*. (Magnification 100x) (Putri., *et al*., 2018)

Gyrodactylus sp. has an elongated body shape, on the anterior part there is a body part that is shaped like two antennae, has a mouth, pharynx and opisthaptor on the posterior part which is used to attach to the host. The parasite *Gyrodactylus sp*. move actively by using opisthaptors to attach to the host so that this ectoparasite infects many parts of the skin, scales and fins (Reed *et al*., 2012).

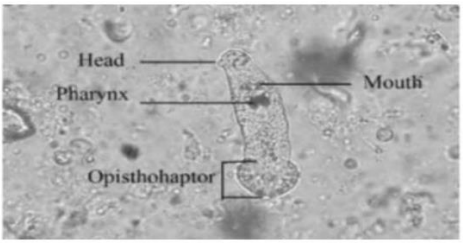

Fig. 3. *Gyrodactylus sp.* (Magnification 400x) (Yulianti., *et al*., 2019)

This is consistent with *Gyrodactylus sp*. which has been found in the gills of koi, where this parasite has an elongated body shape, and the head, mouth and pharynx are also visible. However, the Opisthaptor part is not visible. This is because during the examination, the parasite *Gyrodactylus sp*. Make movements fast enough so that when taking the picture you don't encounter the opisthaptor. Opisthaptor itself has the function of attaching to the host. Meanwhile, the head and pharynx function as digestive organs.

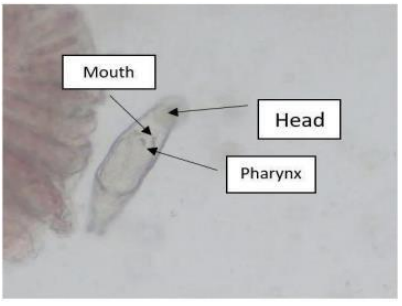

Fig. 4. *Gyrodactylus sp.* on Koi (Magnification 1000x) (Personal Documentation, 2024)

Fish attacked by *Gyrodactylus sp*. At high intensity, it will show signs of pale skin, red spots on certain parts of the skin, abnormal mucus production, and peeling skin (Saselah & Manurung, 2017). Apart from that, the fish looks limp, swims near the surface and its fins are closed. If the gills are attacked, the fish's gills will become swollen and pale, resulting in disruption of the respiration and osmoregulation processes, causing the fish to be less tolerant of low oxygen conditions, so that the fish often appear to swim to the surface to take in oxygen (Sejati 2011).

Trichodina sp.

Trichodina sp. is an ectoparasite that, when infecting fish, can cause damage to external organs such as the skin, gills, and fins, and is known as trichodiniasis (Conchita, 2023). Observations indicate that ornamental fish infected with Trichodina sp. exhibit several symptoms, including slow movement in the water, increased mucus production, external bleeding, dull body coloration, and frequent rubbing of their bodies against the walls of the aquarium or pond.

Trichodina sp. is often found in mucus because the mucus on the fish's body surface is directly related to the environment and serves as a favorable habitat for ectoparasites. *Trichodina sp*. attaches to the body surface and rotates 360° using cilia, causing damage to surround cells and feeding on destroyed epithelial cells, resulting in irritation to the body surface (Sembiring, 2021). However, in most cases, *Trichodina sp*. can also penetrate into the gills due to the porous and folded morphology of the gills, providing a suitable habitat for *Trichodina sp*. to attach and reproduce (Rosita, 2024). Additionally, the gills are where oxygen and carbon dioxide exchange occur, making them rich in nutrients such as protein and carbohydrates (Purwanti, 2018). *Trichodina sp*. can utilize these nutrients for growth and reproduction (Mora, 2022). Furthermore, the gills also contain blood cells and other organic matter that can serve as a food source for *Trichodina sp*.

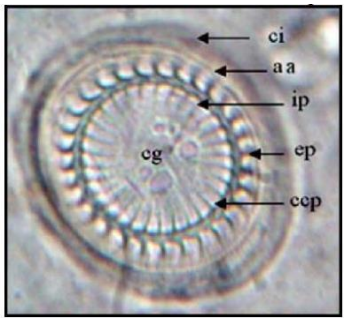

Fig. 4. Parasite *Trichodina sp.* on *Channa punctatus*
aa = adhesive apparatus, ccp = central conical part, cg = central granule, ci = cilia, ep = external processes and ip = internal processes
(Bashe, 2010)

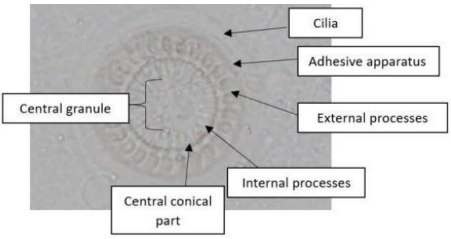

Fig. 5. Parasite *Trichodina sp*. on Koi (Magnification 1000x)
(Personal Documentation, 2024)

The body morphology of Trichodina sp. ranges from 0.15 to 20 mm and consists of cilia, adhesive apparatus, external processes, internal processes, central conical part, and central granule. Trichodina sp. has a disc-shaped body surrounded by cilia (Panduheriana, 2019). This parasite moves continuously from one part of the host's body to another using cilia, and the body parts it leaves behind undergo detachment (Utami, 2018). Trichodina sp. has an adhesive apparatus (adhesive circle). The presence of the adhesive apparatus in Trichodina sp. serves to attach itself to the host fish's body (Yulianti, 2019). The external processes consist of false hooks with thicker dark-edged spots inside, while the free end is blunt or more rounded. The internal processes are elongated needle shaped structures that are usually curved (Bashe, 2010). In the middle part, there is a central conical part or cone-shaped teeth (Bashe, 2010). Then there is a central granule that appears as a white spot. Some studies suggest that the central granule is an additional feature inherited for taxonomic determination (Wang, 2019).

Trichodina sp. will not cause serious impact when present in small numbers, but if the infection by this parasite is severe, it can lead to the formation of open wounds on the fish's body surface (Laia, 2018). These wounds can serve as carriers for other more dangerous pathogens (Lom, 1995; Van As and Basson, 1989; Basson et al., 1983).

Table 2. Prevalence of the Parasite *Dactylogyrus sp.* in freshwater ornamental fish

Fish Type	∑ sample (tail)	∑ infected (tail)	Prevalence (%)
Black Tetra (*Gymnocorymbus ternetzi*)	20	8	40
Koi (*Cyprinus rubrofuscus)*	20	13	65
Goldfish *(Carassius auratus)*	20	11	55
Manfish (Pterophyllum scalare)	20	13	65
Patin Fish (Pangasianodon hypophthalmus)	20	2	10

Table 3. Prevalence of the Parasite *Gyrodactylus sp.* in freshwater ornamental fish

Fish Type	∑ sample (tail)	∑ infected (tail)	Prevalence (%)
Black Tetra	20	0	0

(*Gymnocorymbus ternetzi*)			
Koi (*Cyprinus rubrofuscus)*	20	3	15
Goldfish *(Carassius auratus)*	20	1	5
Manfish (Pterophyllum scalare)	20	0	0
Patin Fish (Pangasianodon hypophthalmus)	20	1	5

Table 4. Prevalence of the Parasite *Trichodina sp.* in freshwater ornamental fish

Fish Type	∑ sample (tail)	∑ infected (tail)	Prevalence (%)
Black Tetra (*Gymnocorymbus ternetzi*)	20	0	0
Koi (*Cyprinus rubrofuscus)*	20	6	30
Goldfish *(Carassius auratus)*	20	9	45
Manfish (Pterophyllum scalare)	20	1	5
Patin Fish (Pangasianodon hypophthalmus)	20	4	20

3.2 Prevalence of Parasites in Freshwater Ornamental Fish

Prevalence refers to the percentage of fish infected with parasites or the overall proportion of organisms in a fish population at a certain time without considering the time of infection (Makmura *et al*., 2023). Of all the types of fish examined, the parasites *Dactylogyrus sp*., *Gyrodactylus sp*., and *Trichodina sp*. were found. in several types of fish with the following prevalence rates:

Dactylogyrus sp.

Parasite *Dactylogyrus sp*. found in various species studied, namely in Black Tetra fish (*Gymnocorymbus ternetzi*), Koi (*Cyprinus rubrofuscus*), Goldfish (*Carassius auratus*), Angelfish/Manfish (*Pterophyllum scalare*), and Patin (*Pangasianodon hypophthalmus*). The samples used in this research were 20 fish samples each.

In black tetra, 8 infected samples were found, so it has a prevalence rate of 40% (usually). In koi, 13 infected samples were found so it had a prevalence rate of 65% (Very Frequent). In goldfish, 11 infected samples were found so it had a prevalence rate of 55% (Very Frequent). In manfish, 13 infected samples were found so it had a

prevalence rate of 65% (very often). And finally, 2 patin were found to be infected, so it had a prevalence rate of 10% (often).

Gyrodactylus sp.

The parasite *Gyrodactylus sp*. found in the species studied, namely in Koi (*Cyprinus rubrofuscus*), Koki (*Carassius auratus*), and Patin (*Pangasianodon hypophthalmus*). Meanwhile, in Black Tetra fish (*Gymnocorymbus ternetzi*) and Angel Fish/Manfish (*Pterophyllum scalare*) this parasite was not found. The samples used in this research were 20 fish samples each.

In black tetra fish, no infected samples were found so it has a prevalence rate of 0% (almost never). In koi, 3 samples were found to be infected, so it had a prevalence rate of 15% (often). In goldfish, 1 infected sample was found so it had a prevalence rate of 5% (sometimes). In manfish, no infected samples were found so it has a prevalence rate of 0% (almost never). And finally, 1 patin was found to be infected, so it had a prevalence rate of 5% (sometimes).

Trichodina sp.

Parasite *Trichodina sp*. found in various species studied, namely Koi (*Cyprinus rubrofuscus*), Koki (*Carassius auratus*), Angelfish/Manfish (*Pterophyllum scalare*), and Patin (*Pangasianodon hypophthalmus*). Meanwhile, this parasite was not found in Black Tetra fish *(Gymnocorymbus ternetzi*). The samples used in this research were 20 fish samples each.

In black tetra fish, no infected samples were found so it has a prevalence rate of 0% (almost never). In koi, 6 samples were found to be infected, so it has a prevalence rate of 30% (generally). In goldfish, 9 infected samples were found, giving a prevalence rate of 45% (generally). In manfish, 1 sample was found to be infected so it had a prevalence rate of 5% (sometimes). And finally, 4 of the patin were found to be infected so it had a prevalence rate of 20% (often).

3.3 Prevention and Treatment of Parasites in Fish

Prevention of parasites in freshwater ornamental fish is crucial to ensure their health and survival (Yanuhar, 2023). To maintain the health of freshwater ornamental fish, a comprehensive prevention approach is necessary. Some steps to prevent parasitic infections in freshwater ornamental fish include maintaining good water quality management, quarantining fish, routine monitoring, and cleanliness and sterilization.

The use of safe and environmentally friendly chemicals is one of the methods widely employed in the treatment of parasitic diseases and has long been practiced in fish farming processes (Andriyanto, 2018). Some chemicals permitted for use in the prevention and treatment of parasites in fish include acetic acid, betadine, bithionol, chloramin-t, copper sulfate, formaldehyde, hydrogen peroxide, ivermectin, levamisole,

mebendazole, niclosamide, potassium permanganate, praziquantel, salt, and trichlorfon (Kayis *et al*., 2009).

Preventing attacks from *Gyrodactylus sp*. and *Dactylogyrus sp*. parasites can be achieved by applying lime (CaO) at a dosage of 25 kg/ha to ponds that have been dried for 2-3 days. Alternatively, disinfection methods using methylene blue can be employed at a dosage of 1 gram/m3 (Kordi & Ghufran 2004). As for the treatment of fish infected with *Gyrodactylus sp*. and *Dactylogyrus sp*. parasites, immersion of the infected fish in a salt (NaCl) solution at a dosage of 12.5- 13 grams/m3 for 24-36 hours can be conducted (Hasyimia, 2016).

The treatment of *Trichodina sp*. parasite disease in fish was previously conducted using chemicals and antibiotics such as NaCl, formalin, and CuSO4 (Chandra, 2014). However, continuous use of antibiotics and chemicals can lead to side effects on fish and their environment. As an alternative, research has shown that the use of natural ingredients such as mangrove leaf extract (*Avicennia marina*) is effective in treating the disease (Afifah, 2014). This research indicates that mangrove leaves (*Avicennia marina*) have the potential as antibacterial agents because they contain several polar compounds. Compounds contained in mangrove leaves such as saponins, flavonoids, and tannins, have the ability to control the growth of *Trichodina sp*. (Mulia & Vauziyyah, 2021). Flavonoids can cause damage to cell membranes through the denaturation of proteins, thus inhibiting growth and leading to the death of the *Trichodina sp*. parasite (Afifah, 2014). Saponins work by inhibiting the formation of hydrogen bonds with cell membranes, thereby disrupting membrane permeability and ultimately causing cell death (Soraya *et al*., 2019). Tannins have spasmolytic properties that cause cell membranes to shrink and disrupt membrane permeability, thereby interfering with cell activity, inhibiting growth, and even causing cell death (Ciptaningrum, 2019).

4 Conclusion

Three types of parasites found in freshwater ornamental fish in Jakarta, identified at the Fish Quarantine Laboratory and Jatinegara Market are *Dactylogyrus sp.*, *Gyrodactylus sp.*, and *Trichodina sp*. The parasites that attack koi, goldfish, andpatin fish are *Trichodina sp.*, *Dactylogyrus sp.*, and *Gyrodactylus sp.* The parasite that attacks black tetras is *Dactylogyrus sp.* Furthermore, the parasites that attack angelfish are *Trichodina sp.* and *Dactylogyrus sp.*The highest prevalence of Dactylogyrus sp. was found in koi (*Cyprinus rubrofuscus*) and manfish (*Pterophyllum scalare*) with a prevalence rate of 65%. The highest prevalence of *Gyrodactylus sp.* was found in koi (*Cyprinus rubrofuscus*) with a prevalence rate of 15%. The highest prevalence of *Trichodina sp.* was found in goldfish (*Carassius auratus*) with a prevalence rate of 45%. The organ of fish most commonly attacked by ectoparasites like *Dactylogyrus sp.*, *Gyrodactylus sp.*, and *Trichodina sp.* is the gills. This is because they contain blood cells and other organic materials that serve as food sources for the parasites. For future research, it is recommended to investigate the diversity and distribution of ectoparasites among various species of freshwater ornamental fish outside Jakarta.

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