Jurnal Sains Akuakultur Tropis
Departemen Akuakultur
Fakultas Perikanan dan Ilmu Kelautan – Universitas Diponegoro
Jl. Prof. Soedarto, SH, Tembalang,Semarang 50275
Telp. (024) 7474698, Fax.: (024) 7474698
Email: sainsakuakulturtropis@gmail.com, sainsakuakulturtropis@undip.ac.id

PREVALENCE OF ECTOPARASITES IN BETTA FISH (*Betta splendens R*) IN PEKALONGAN CITY

Linayati Linayati *, Tri Yusufi Mardiana, Ishadiyanto, Muhammad Zulkham Yahya
Departement Aquaculture, Fisheries Faculty, Pekalongan Unuiversity
Sriwijaya Street No 3rd Pekalongan
*Email: Pattyana95ina@yahoo.co.id

ABSTRACT

In Pekalongan City, Betta fish, or Siamese fighting fish is gaining popularity. However, many problems often occur in Betta fish care, such as disease attacks from parasites, including ectoparasites. This research identified the types of ectoparasites in Betta fish and determined its prevalence and degree of infection in betta fish in Pekalongan City. In this exploratory research, data were descriptively analyzed. The data were obtained from 60 samples of betta fish measuring 3.5–5.6 cm taken from betta farmers in Pekalongan City. The results of this research revealed that *Tetrahymena sp* and *Ichthyopthirius multifilis* had different prevalence levels of 46.66% for that 3.5 – 4.5 cm in length, and 43.33% of fish with 4.6-5.6 cm long, respectively 44,6 % and 40 % for *Ichtyoptirius multifilis*. The infection value was 6.79/fish for *Tetrahymena sp* (moderate), and 4.6/fish for *Ichthyopthirius multifilis* (low). The water quality parameters were; the temperature of 27.1 – 28.9^{0}C, DO 5.8 – 8.2 mg/l, and a pH of 6.3 – 7.3.

Keywords: *Ectoparasite, Betta Fish, Prevalence, Tetrahymena*

INTRODUCTION

Ornamental fish has been a promising business commodity lately as it is highly valued. One of the most favorite ornamentals is betta fish (*Betta splendens R*) or Siamese fighting fish. The fish has a beautiful shape, color, and fins with exquisite beauty, making it a star in fish exhibition events.

Despite its elegancy, betta fish is tremendously aggressive against those of the same sex. Gumilang *et al.,* (2016) does not recommend keeping the fish in the same container. In the wild, betta fish can be found in calm currents such as rivers, swamps, and lakes (Awaludin *et al.,* 2019). In Pekalongan, betta fish is also very popular. Many citizens are engaged in betta fish farming as more people become betta fish lovers and betta fish contests are often held.

Unfortunately, fish diseases that commonly attack betta fish make it challenging to care for the fish. Parasites often attack both ornamental fish and consumption fish. Linayati *et al.,* (2021) mentioned several parasites that cause fish diseases such as bacteria, fungi, viruses, and protozoan organisms. Parasites are divided into 2, namely ectoparasites (parasites that attack the external parts of the fish) and endoparasites (parasites that attack the internal parts of the fish).

Endoparasites that attack fish can be worms or protozoa. *Anisakis sp* is an endoparasite worm commonly found in tuna of 19-24 cm in size with a prevalence of up to 60% (Linayati, 2018). Moreover, *Capillaria sp* worms in betta fish are often found in betta fish of 3.5-4.5 cm in size with a prevalence of 36.5% (Linayati *et al,* 2021). Ectoparasites in the fish remain a classic issue. Even though the loss due to ectoparasite infection is not greater than in other pathogenic infections, (Fidyandini *et al.,* 2012) but Helmiati *et al.,* (2005) found that these parasites transmit more quickly and easily. Mulia (2010) stated that ectoparasite infection can lead to acute asymptomatic death and makes the fish more vulnerable to get pathogenic infections.

Information about ectoparasites that specifically attack betta fish in Pekalongan City is still limited. Therefore, an inventory of ectoparasites on betta fish in Pekalongan City was carried out to provide references and insights on how to provide better care for betta fish. This research identified the types of ectoparasites and the prevalence and degree of infection in betta fish in Pekalongan City.

MATERIALS AND METHOD

The research was carried out from December 8th – to December 25th, 2021. Betta fish samples were taken from Betta fish farmers in Pekalongan City. Observations of ectoparasites were carried out at the Biology Laboratory of Universitas Pekalongan. The data of this exploratory research were analyzed descriptively.

Materials and Equipment

The equipment used in this research were a petri dish, tweezers, ruler, needle ose, tray, scalpel, microscope, tissue, measuring cup, and stationery. Whereas, the materials used included distilled water, alcohol, and 60 samples of betta fish from betta fish farmers in Pekalongan city. The samples were grouped into 2 groups; the group of fish with 3.5 – 4.5 cm in size and fish with 4.6 – 5.6 cm in size.

Research Procedure

Before the examination of the sample fish, fish were first killed by piercing a needle right in the medulla oblongata. Then, fish skin, scales, and head to tail were scrapped using a scalpel to obtain the mucus fluid. Then the mucus fluid was put on an object-glass, dripped with distilled water, covered with a cover glass, and observed under a microscope. The infection prevalence and degree of infection were measured based on the formula proposed by Kabata (1985) as follows.

$$\text{Prevalence} = \frac{\sum \text{fish with infection}}{\sum \text{fish examined}} \; X \; 100$$

$$\text{Degree of infection} = \frac{\sum \text{parasites found}}{\sum \text{fish with infection}}$$

After that, supporting data were measured, including data on the water temperature, pH, and DO. All data were then descriptively analyzed. The values obtained are then entered into categories based on William and Jones (1993). The numeric data is analyzed through the process of editing, coding, and then tabulated into tables.

Water quality measurements use equipment such as thermometers for temperature, pH meters to see acidity levels, and DO meters to check oxygen levels. Water quality measurement is carried out once a week

RESULTS AND DISCUSSIONS

The Types of Ectoparasites Identified

Several ectoparasites were identified in fish samples which included *Tetrahymena sp*. The microscopic observation revealed that the parasites had pyriform body shape, oval, pear shape, radially symmetrical body, and cilia all over the body, with the narrowed anterior end. The morphology matched with Hoffman et al's (1975) explanation. Astrofsky *et al* (2002) described the features of protozoan *Tetrahymena sp* which is 50-100 µm in length and has a width of 30-60 µm. Leibowitz and Zilberg (2009) also added that *Tetrahymena sp* has an oval macronucleus measuring 18.25 x 16.83 m and one micronucleus measuring 5.73 x 5.40 m. The picture of *Tetrahymena sp* with pear shape body under microscope could be seen in figure 1.

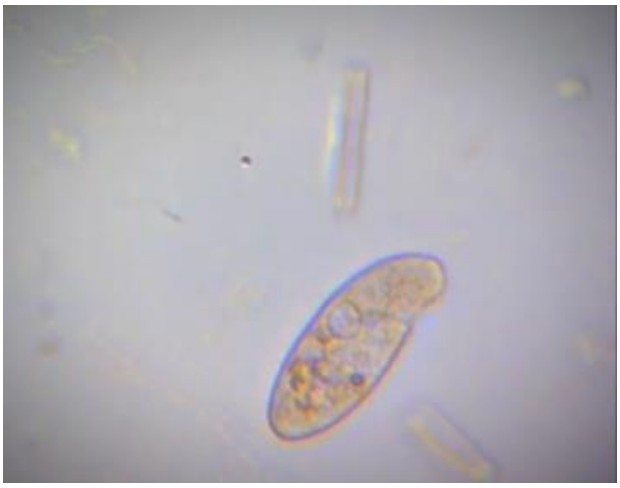

Figure 1. The Picture of *Tetrahymena* sp under the microscope with enlarge 40 x 10

Ichthyopthirius multifilis ectoparasite was also found in the mucus of fish with white spots marked on the surface of the skin, gills, and fins. Kordi (2004) stated that *Ichthyopthyrius multifiliis* makes fish reluctant to swim. The disease is called Ichthyopthiriasis characterized by white spots and Ich. Ich is an obligate parasite that is broadly found in every part of the world and it attacks all types of freshwater fish around the world. If *Ichthyopthyrius multifiliis* attacks the gills, the gills will be damaged, hampering the process of gas exchange (oxygen, carbon dioxide, and ammonia).

This disease is a serious disease with high mortality (up to 90%) and significant economic losses in the consumption of fish and tropical freshwater ornamental fish. Ich attacks are extremely malignant in aquarium conditions where the volume of water is small. The protozoa will also leave a dead host and it reproduces by forming cysts on the substrate, thereby potentially infecting other hosts (Purbomartono, 2010). Infected fish look pale and redish on their body could be seen in Figure 2.

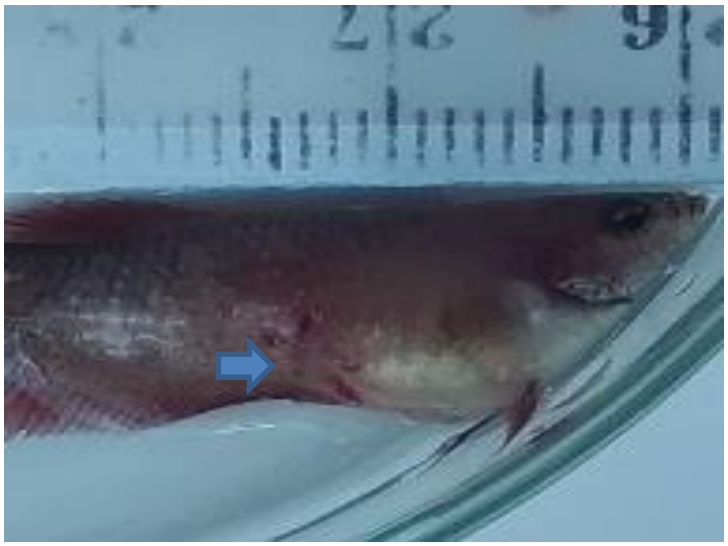

Figure 2. Betta fish infected with *Ichthyopthyrius multifilis*
(Narrow: redish on the skin due to infection)

The Prevalence and Infection Degree of Ectoparasites

The prevalence of *Tertrahymena sp*. in betta fish of 3.5-4.5cm in size was 46.66%, and 43.33% in those of 4.6-5.6 cm size. Referring to the categorization, the infection prevalence in both groups was categorized as general prevalence with common infections. It implies that *Tetrahymena sp.* is a common infection in betta fish.

Table 1. The Prevalence of Ectoparasite Infection

Parasites	Fish Size (cm)		Value (%)	Category
	3.5 – 4.5	4.6 – 5.6		
Tetrahymena sp	46,6%	43,33%	30-49	General Infection (Common)
Ichtyophthirius multifilis	44,6%	40 %	30-49	General Infection (Common)

Although it is a general infection, fish in the first group with 3.5-4.5cm bigger than the second group had a higher prevalence due to the larger size. The immune system of larger fish will be stronger than that of smaller ones. Munajat and Budiana (2003) explained that the degree of infection of a disease depends on the type and number of microorganisms that attack the fish, environmental conditions, and the fish's immune system.

The degree of infection of *Tetrahymena sp.* was 6.79 (moderate). This shows that the severity of *Tetrahymena sp.* attack seems to keep increasing since there were 6.79 *Tertahymena sp*. per individual fish. This parasite can leave spores on the substrate and water which will eventually infect other fish. Purbomartono (2010) stated that *Tetrahymena* will leave a dead host and it reproduces by spores that can potentially infect other fish. This parasite is often found in dirty waters and the bodies of stressed fish. Aquariums with dirty water and fish feces accumulated at the bottom of the aquarium are where the parasite is often found. Tetrahymena has ciliary extremities which can attack various fish species, although it is more commonly found in guppies (Sharon *et al.*, 2014).

Leibowitz *et al.,* (2009) stated that poor water quality, including waters polluted with ammonia and organic matter as well as low water temperatures, increase the susceptibility of fish to infection. The high content of organic matter and nutrients are food for parasites, where the parasite can grow a larger population. *Tetrahymena sp* was also found in 50 of 590 guppies in Sri Lanka (Thilakaratne *et al.,* 2003). Degre of infection of Betta fish in this study could be separated into two categories could be seen in Table 2.

Table 2. Ectoparasite Infection Degree in Betta Fish

Parasites	Value of Infection	Range	Category
Tetrahymena sp	6,79	6-22	Moderate
Ichtyophthirius multifilis	4,6	1-5	Low

The prevalence of *Ichtyophthirius multifilis* in 3.5-4.5cm betta fish is 44.66%, while at 4.6-5.6cm it is 40%. Based on the value criteria table above, shows that groups of fish with a size of 3.5-4.5cm and 4.6-5.6cm are both in the general prevalence category with common infections. This means that the incidence of infection with *Ichtyophthirius multifilis* is generally found in betta fish or in general, it is often found in betta fish.

Although it is included in the general infection category, the first group of fish with a size of 3.5-4.5cm has a higher prevalence value than the second group. This can happen because the second group has a larger size and the immune system and body resistance are better than those of smaller body sizes.

The degree of *Ichtyophthirius multifilis* infection was 4.6 (low). Hence, *Ichtyophthirius multifilis* infection is not too dangerous because there were only 4.6 *Ichtyophthirius multifilis* found per individual fish. However, the presence of parasites in the fish's body will interfere with the metabolism. Fish with poor metabolism show lower physical quality, especially ornamental fish. Poor metabolism can lead to changes in fish movement and color of ornamental fish that can affect the selling price.

Ichthyopthyrius multifiliis is an ectoparasite in freshwater fish that can cause a disease called white spot disease or ich. This disease attacks the fins and gills as shown by white spots that look like salt. This disease has a rapid reproductive cycle and a unique life stage. Improper control of this disease will lead to higher mortality. Kordi (2004), explained that fish infected with *Ichthyopthyrius multifiliis* are more reluctant to swim and they have white spots on the surface of the skin, gills, and fins. *Ichthyopthyrius multifiliis* that attack the gills will bring damage to the fills that the process of gas exchange (oxygen, carbon dioxide, and ammonia) is hampered.

The presence of *Ichtyoptirius multifilis* is determined by its life cycle as a spore. Spores containing Ichtyoptirius seeds can spread in the water which eventually infects the skin of the fish. Spores can also stay and transport in unsterile feed and equipment. According to Kabata (1985), the skin and scales of fish contain mucus, making them vulnerable for ectoparasites to grow. Parasites transmit the culture area through unsterile equipment or containers brought from other places.

Water Quality

The results of water quality measurements are presented in Table 3. The water sample was taken from each container.

Table 3. Result of Water Quality Measurement

Parameters	Value	Optimal Range	References
Temperature(°C)	27,1 – 28,9	24 – 30	Brownell (2014)
pH	6,3 – 7,3	6,2 – 7,5	Pebriansyah (2015)
DO (mg/l)	5,8 – 8,2	>3	Saltas *et al.*, (2022)

Water quality parameters which included water temperature, pH, and DO were regarded as ideal to support the growth and life of betta fish. Water quality has greatly affected fish metabolism so it must always be maintained properly.

CONCLUSIONS AND SUGGESTIONS

Conclusions

Regarding the results of ectoparasite and endoparasite identification in Betta fish in Pekalongan City, conclusions were drawn as follows.

1. The types of ectoparasites found in this research were *Tetrahymena sp* and *Ichthyophthirius multifilii*
2. The prevalence of *Tetrahymena sp* and *Ichtyoptirius multifilis* infections were 46.66% (common) in fish of 3.5-4.5cm in size and 43.33% in fish of 4.6-5.6 cm in size (common).

Suggestions

Regular checks on the presence of parasites in Betta fish bred by ornamental fish farmers in Pekalongan City should be conducted to maintain the quality and economic value of Betta fish.

REFERENCES

Astrofsky KM, Schech JM, Sheppard BJ, Obenschain CA, Chin AM, Kacergis MC, Laver ER, Bartholomew JL, Fox JG. 2002. High mortality due to *Tetrahymena* sp. infection in laboratory-maintained zebrafish (*Brachydaniorerio*). *Comparative Medicine*, 52(4): 363–367.

Awaludin., Maulinawati, D., & M. Adriansyah. 2019. Potensi Ekstrak Etanol Seledri (*Apium graveolens*) untuk Maskulinisasi Ikan Cupang (*Betta* sp). *Jurnal Sumberdaya Akuatik Indopasifik*, 3(2): 101–114.

Brownell, A. 2014. *A Study of Female Courtship Behavior and Mating Preferences in Betta splendens*. Lake Forest College Publications. Lake Forest College. Theses. 58 p.

Fidyandini, H.P., Subekti, S., & Kismiyati. 2012. Identifikasi dan Prevalensi Ektoparasit pada Ikan Bandeng (*Chanos chanos*) yang Dipelihara di Keramba Jaring Apung UPBL Situbondo dan di Tambak Desa Bangunrejo Kecamatan Jabon Sidoarjo. *Journal of Marine and Coastal Science*, 1(2): 91–112.

Gumilang, B.I., I.K. Artawan & N.L.P. Widayanti. 2016. Variasi Intensitas Cahaya Mengakibatkan Perbedaan Kecepatan Regenerasi Sirip Kaudal Ikan Cupang (*Betta splendens*) Dipelihara Di Rumah Kos. *Jurnal Jurusan Pendidikan Biologi*, 4 (2): 15–21.

Helmiati, S., Triyanto, & H.N. Kamiso. 2005. Prevalensi dan Derajat Infeksi *Myxobolous* sp. Pada Insang Benih Karper (*Cyprinus carpio*) di Kabupaten Sleman. *Jurnal Perikanan*, 47–53 p.

Hoffman, G.L., Lando, M., Camper, J.E., Coats, D.W., Stookey, L., Burek, J.D. 1975. A disease of freshwater fishes caused by *Tetrahymena corlissi* Thompson, 1955 and key for identification of holotrich ciliates of freshwater fishes. *Journal of Parasitology*, 61 (2): 217–223.

Kabata, Z. 1985. Parasites and disease of fish cultured in the tropics. Taylor and Francis, London, UK. ...

Kordi, K. 2004. *Penanggulangan Hama dan Penyakit Ikan*. Rineka ciptadan Bina Adiaksara. Jakarta. 194 p

Leibowitz MP, Ariav R, and Zilberg D. 2009 Environmental and Physiological condition affecting Tetrahymena infection in guppy, *Poecilia reticulata* Peters: *Journal of Fish Diseases*, 28: 539–547.

Leibowitz, M.P.,& Zilberg, D. 2009 *Tetrahymena* sp. infection in guppy, *Poecilia reticulata* Peters: parasite characterization and pathology of infected fish. *Journal of Fish Diseases*, 32: 845–855.

Linayati.,Linayati.2018. Derajat Infeksi dan Prevalensi Cacing Anisakis sp Pada Ikan Tongkol (*Euthynnus affinis*) di TPI Kota Pekalongan. *PENA akuatika* Vol 1 (2):34-41

Linayati., T.Y. Mardiana., Ishadiyanto., M.B. Syakirin., & Soeprapto, H. 2021. Identifikasi Endoparasit pada Ikan Cupang (*Betta splendens* R) di Kota Pekalongan. *PENA Akuatika*, 20(2): 1–10.

Mulia, D.S. 2010. Tingkat Infeksi Ektoparasit Protozoa pada Benih Ikan Nila (*Oreochromis niloticus*) di Balai Benih Ikan (BBI) Pandak dan Sidobowa, Kabupaten Banyumas. *Sains Akuatik*, 10(1): 1–11.

Munajat, A., & N.S. Budiana. 2003. *Pestisida Nabati untuk Penyakit Ikan*. Penebar Swadaya. Jakarta. 87 p

Pebriansyah, M. 2015. *Pengaruh Sex Reversal Munggunakan Hormon 17α-Metilltestoteron Terhadap Intensitas Warna Ikan Cupang (Betta sp.) Jantan XX dengan Jantan XY*. Skripsi. Universitas Lampung. Lampung.

Purbomartono C. 2010. Identify of helminth and crustacean ectoparasites on *Puntius javanicus* fry at local hatchery center Sidabowa and Kutasari. *Sains Akuatik* 10(2): 134–140.

Saltas, H.F., Muchlisin, Z.A., & Damora, A. 2022. Pengaruh Penambahan Ekstrak Tembakau (*Nicotiana tabacum*) terhadap Kondisi Histologi Ikan Cupang (*Betta splendens*). *Jurnal kelautan dan Perikanan Indonesia*, 1(2): 75–84.

Sharon G, M Pimenta Leibowitz , J Kumar Chettri , N Isakov , D Zilberg. 2014. Comparative study of infection with Tetrahymena of different ornamental fish species. J Comp Pathol 150(2-3):316-24. doi: 10.1016/j.jcpa.2013.08.005.

Thilakaratne ID, Rajapaksha G, Hewakopara A, Rajapakse RP, Faisal AC. 2003. Parasitic infections in freshwater ornamental fish in Sri Lanka. Dis Aquat Organ. 2003 Mar 31;54(2):157-62. doi: 10.3354/dao054157.PMID: 1274764

Williams, H., and Jones, A., (1993). Parasitic Worm of Fish. Taylor and Francis Ltd., London, United Kingdom: 593 pp