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Ectoparasite Identification in Juvenile Koi Fish (*Cyprinus rubrofuscus*) in Tanjung Bunga Lake, Makassar City

(Identifikasi Ektoparasit pada Ikan Koi Muda (Cyprinus rubrofuscus) di Danau Tanjung Bunga, Kota Makassar)

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ABSTRAK

Keberhasilan budidaya ikan koi sangat bergantung pada produksi stok anakan ikan koi yang sehat dan berkualitas tinggi. Namun, berbagai tantangan, termasuk infestasi ektoparasit, dapat berdampak signifikan pada kesehatan dan pertumbuhan populasi ikan koi. Penelitian ini bertujuan untuk mengidentifikasi ektoparasit yang menyerang ikan koi muda dan menilai kualitas air di Danau Tanjung Bunga, Kota Makassar. Sebanyak 60 sampel ikan koi muda dari tiga titik keramba diperiksa melalui metode scraping, kemudian pewarnaan cacing parasit dilakukan dengan menggunakan pewarnaan semichon's acetocarmine. Hasil penelitian menunjukkan dominansi Dactylogyrus sp. (52,6%), Trichodina sp. (26,3%), dan Myxobolus sp. (21%). Selain itu, analisis kualitas air menunjukkan konsentrasi oksigen terlarut (DO) di bawah 5 mg/L, yang menunjukkan kondisi lingkungan yang kurang optimal. Penelitian ini menyoroti dominansi infeksi ektoparasit pada ikan koi muda, dengan Dactylogyrus sp. sebagai parasit yang paling dominan, hal ini menunjukkan bahwa perlunya strategi pengelolaan yang lebih baik dalam budidaya ikan koi.
***Keywords**: Dactylogyrus sp.; koi; Myxobolus sp.; Trichodina sp.*

PENDAHULUAN

Koi (*Cyprinus rubrofuscus*) is an ornamental fish of high economic value and is in demand worldwide, including in Indonesia (Putri & Dewi, 2019). One of the growing areas of koi farming is Tanjung Bunga Lake in Makassar City, which provides a natural aquatic environment for koi growth. However, this open environment often increases the risk of ectoparasite infestation, which can affect the health and quality of koi, especially during the juvenile stage (Hasan *et al*., 2016).

Ectoparasites are organisms that live outside the host's body and can cause irritation, injury, and even death if severe infestation occurs. Koi fish infested with ectoparasites often exhibit clinical signs such as open wounds, fin damage, and reduced feeding and growth. Ectoparasite infestation can also cause fish stress, worsen overall health, and reduce resistance to secondary infections. The implications of ectoparasitic infestations extend beyond individual fish health, impacting the overall productivity and sustainability of koi farming operations. As highlighted in studies from various regions, such as Sukabumi and Blitar Regency, high densities of koi can exacerbate the prevalence of parasites like *Trichodina* sp., *Chilodonella* sp., *Myxobolus* sp., *Ichthyophthirius multifiliis*, *Dactylogyrus* sp., *Gyrodactylus* sp., and Argulus japonicus, leading to significant economic losses for farmers due to decreased growth rates and increased mortality (Acosta-Pérez *et al*., 2022). Moreover, environmental factors, such as water quality, play a crucial role in parasite proliferation; low dissolved oxygen levels stress the fish and create favorable conditions for ectoparasite survival (Islam et al., 2024). A significant factor in determining fish survival is water quality (Fekri *et al*., 2018). In parasites, high environmental temperatures generally result in faster growth and development times because the life cycle can be completed more quickly (Hunt & Cable, 2020).

Tanjung Bunga Lake, in the middle of a settlement in the Tanjung Bunga area, is one of the koi-farming sites in the western part of Makassar City. The lake's position in the middle of a residential area and its water supply from the downstream Jeneberang River make it vulnerable to pollution from various sources, including road runoff, garbage, domestic waste disposal, and contaminants transported by the Jeneberang River (Sulfikar, 2013). Research on ectoparasites in juvenile koi fish in this lake has yet to be conducted and published. This study aims to identify ectoparasites in juvenile koi and to evaluate water quality in Lake Tanjung Bunga, Makassar City. Considering that many local people utilize Tanjung Bunga Lake to cultivate koi fish, this study is expected to provide valuable baseline data for farmers and local governments in developing disease prevention and control strategies in open-water koi farming.

MATERIALS AND METHODS

The research tools used in this study included aerators, pH paper, a spectrophotometer, a refractometer, and a thermometer. Juvenile koi fish were sampled using the random sampling method, from March to April 2024, A total of 60 juvenile koi fish samples aged 3 to 4 months with an average body length of 8-12 cm were taken, and water samples were taken at Lake Tanjung Bunga, Makassar City at three cage points: the west, the south, and the north.

Figure1. Research map (Source: Personal Documentation)

The examination is carried out using the scraping method, which involves taking mucus from the body surface and the gills of the fish using a covered glass. The scraping results were placed on an object glass with a drop of distilled water for observation under a microscope. Positive samples for trematode worm ectoparasites are permanently stained using semichon acetocermine stain. The samples were stored by immersing the specimens in 70% ethanol for 10 minutes, followed by immersion in semichon acetocermine solution for 15 to 20 minutes. After immersion, the specimens were rinsed with 70% ethanol and dipped in an acid alcohol solution. The specimens were dehydrated using graded alcohol (70%, 85%, 95%, and 100%) by immersing them for 5 minutes at each alcohol concentration level. Next, the specimens were dipped in xylol until they were translucent. Finally, the specimens were mounted using entellan.

Water quality measurements were conducted simultaneously with sampling at Tanjung Bunga Lake, Makassar City. 100 ml of lake water was placed into a glass bottle. Parameters observed in the field were pH, salinity, and temperature using a thermometer, litmus paper, and a salinity hydrometer. Meanwhile, the examination of dissolved oxygen (DO), ammonia, nitrate, and nitrite was carried out at the Water Quality Laboratory of the Faculty of Marine

Science and Fisheries, Hasanuddin University.

Dominance is a particular type of ectoparasite found to be the most dominant among other ectoparasites (Firdausi *et al*., 2020). Dominance can be calculated using the formula (Figure 2):

$$\text{Dominance} = \frac{\text{the number of one type of parasite that infects}}{\text{the total number of parasites that infect}} \times 100\%$$

Figure 2. The formula

RESULT AND DISCUSSION

Based on the results of the identification of ectoparasites in Figure 2. *Dactylogyrus* sp. dominates ectoparasites in Lake Tanjung Bunga, Makassar City, with a value of 52.6%. *Trichodina* sp. is in second place with a value of 26.3%. Last is *Myxobolus* sp., with a value of 21%. Ten Juvenile koi fish infected with *Dactylogyrus* sp. Four infected juveniles of koi fish were found at the west point, two at the south point, and four at the north point. *Dactylogyrus* sp. is a worm-class parasite that often infects freshwater fish. The predilection of *Dactylogyrus* sp. is in the gills, so this parasite is called a gill worm. Based on the results of the study, it is known that *Dactylogyrus* sp. was found in all ponds, with the highest infestation rate in cage ponds. *Dactylogyrus* sp. is a monogenea that lays eggs and has two pairs of anchors. On the body, there is a posterior haptor. The haptor has no cuticle structure and has a pair of hooks with one row of cuticles, 16 main hooks, and one pair of tiny hooks (Molokomme *et al*., 2023).

Four juvenile koi fish were found infected with *Myxobolus* sp. One infected fish was found at the west point, three fish at the south point, and no positive samples were found at the north point. Based on the microscopic observations of *Myxobolus* sp., the spores of *Myxobolus* sp. are pyriform, flattened on the anterior and widened on the posterior. Polar filaments on *Myxobolus* sp. are circular in a straight, elongated line that pivots on the polar capsule. The posterior part of the spore has the same characteristics and shape, namely the presence of vacuoles. When the sample examination was carried out, a clinical sign was found in white nodules on the gills of koi fish juveniles (Yanuhar *et al*., 2021).

Five juvenile koi fish infected with *Trichodina* sp. were found: one infected fish juvenile at the west point, three at the south point, and one at the north point. Based on the results of microscopic observations, *Trichodina* sp. is a type of protozoan shaped like a plate with cilia on the edges that are used as a means of movement (Firdausi *et al*., 2020). The discovery of *Trichodina* sp. in waters is because this protozoan organism is a passive opportunist, meaning it is naturally present in waters and does not harm other organisms. However, under certain conditions, where the number of *Trichodina* sp. increases rapidly and environmental conditions are no longer conducive to fish, this organism can irritate due to adhesion (Larasati *et al*., 2020). If a thick layer of this parasite covers the fish's body surface, it can cause severe damage to the epidermal cells. Under these conditions, *Trichodina* sp. act like true ectoparasites that feed on the damaged cells and can even penetrate the gills and skin tissues (Firdausi *et al*., 2020).

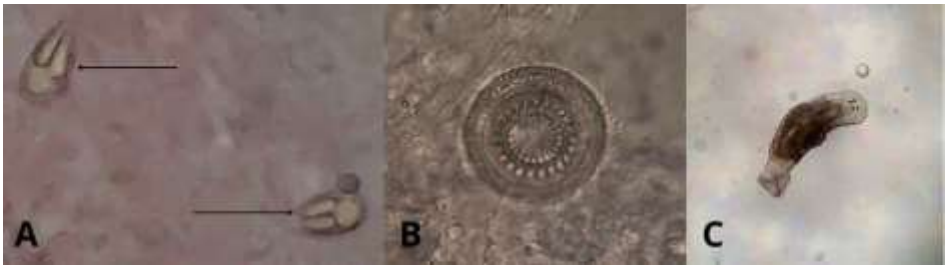

Figure 3. Ectoparasites on juvenile koi fish, (a) *Myxobolus* sp. (b) *Trichodina* sp. (c) *Dactylogyrus* sp

60 juvenile koi fish samples were examined, with an age range of 3 to 4 months; 15 were infected with ectoparasites. Clinical signs found in koi fish juvenile samples in Lake Tanjung Bunga, Makassar City, infected with Myxobolus sp. are white nodules on the gills containing Myxobolus spores. This follows the theory, which states that nodules of fish infected with Myxobolus sp. can be found on the gills (Nurekawati *et al*., 2016). Juveniles of koi fish infected with *Trichodina* sp. showed clinical signs such as detached scales on the body surface, pale gills, and some reddish gills. This follows the theory that fish infected with Trichodina sp. cause bleeding in the gills of fish. In addition, the wounds caused can detach scales, create balance problems, interfere with breathing, and cause death (Elisafitri, *et al*., 2021). Juveniles of koi fish infected with *Dactylogyrus* sp. showed clinical signs of white spots on the gills. Fish infected with Dactylogyrus sp. cause some of the gills to be covered with a layer of mucus and look pale, resembling a mosaic (anemia). The edges of the gills have a whitish-grey discoloration that looks clumpy, and the operculum seems open (10). Clinical signs of infection from these three ectoparasites can be seen in Figure 4. After morphological identification, it was found that the ectoparasites that infected koi fish seeds in Lake Tanjung Bunga were *Myxobolus* sp. (21%), *Trichodina* sp. (26.3%), and *Dactylogyrus* sp. (52.6%) Table 1.

Table 1. Sample infected with ectoparasites

Location	**Number of Fish Sample**	**Infected Fish**		
		***Myxobolus* sp. (%)**	***Trichodina* sp. (%)**	***Dactylogyrus* sp. (%)**
West Point	20	1 (5%)	1 (5%)	4 (20%)
South Point	20	3 (15%)	3 (15%)	2 (10%)
North Point	20	0	1 (5%)	4 (20%)
Total	60	4 (21%)	5 (26.3%)	10 (52.6%)
Dominance		21%	26.3%	52.6%

Figure 4. Clinical signs of ectoparasite infection. (a) Nodules on gills infected with *Myxobolus* sp. (b) Detached, partially pale and reddish scales infected with *Trichodina* sp. (c) White spots on gills infected with *Dactylogyrus* sp.

The results of the water quality examination are presented in Table 2. Several results obtained at the three points are still within the normal range. However, in the DO (Dissolve Oxigen) parameter, three-point cages show a relatively low concentration below 5 mg/L. The ranges of temperature examination results were 29-30 ^{O}C, pH 6, salinity 0 ppm, ammonia 0.0028-0.0080 mg/L, DO 3.20-18.56 mg/L, nitrite 0.0409-0.1849 mg/L, and nitrate 0.0176-0.2173 mg/L. The range of results of this examination, per the typical environment, indicates that ectoparasites can grow and develop well in waters (Fitriani *et al*., 2019). However, judging from the climate of koi fish, the DO concentration at the three points of the cage is below the standard (SNI, 2017). Dissolved Oxygen (DO) is related to ectoparasite abundance, and increased dissolved oxygen (DO) levels in the water lead to an increased DO level in pond waters, causing an increase in ectoparasite abundance. Egg production by *Dactylogyrus* sp. ectoparasites depends on dissolved oxygen levels in the water. Low dissolved oxygen levels produce higher egg production than high dissolved oxygen levels (Hanum & Kurniawan, 2014). This is by the results of ectoparasite identification research, where ectoparasites such as *Dactylogyrus* sp. were found in Lake

Tanjung Bunga, Makassar City, with a DO range of 3.20-18.56 mg/L. The optimal temperature for ectoparasites such as *Trichodina* sp. to grow and develop is 21-26 °C, but these ectoparasites can still survive and grow normally at 27- 32 °C (Fitriani *et al*., 2019). The ectoparasite *Dactylogyrus* sp. has an optimal temperature of 10- 30 °C, and *Myxobolus* sp. at 28- 34 °C (Islam et al., 2024). Water quality and fish environment have a major influence on the presence and development of parasites in the water. This can have a major impact on aquaculture in the waters. High parasite infestation in waters, both ectoparasites and endoparasites, significantly causes decreased fish growth, mortality, and rejection in the market, which ultimately causes losses in the aquaculture industry (Mwainge & Outa, 2022).

Temperature and climate change affect ectoparasites and associated diseases; for example, *Trichodina* will be abundant in the transition from summer to the rainy season, which can result in drastic changes in infection dynamics (Harun *et al*., 2018). The optimal pH for the growth of ectoparasites such as *Trichodina* sp. is in the range of 7-8 (Mahasri *et al*., 2012), and the pH range of 6.9-8 is ideal for the ectoparasite *Dactylogyrus* sp. (Mas'ud *et al*., 2011), and the pH range of 6.5-7 for the ectoparasite *Myxobolus* sp. (Yanuhar *et al*., 2021). Salinity significantly affects the prevalence and intensity of parasites in water. In freshwater, high salinity hurts fish survival rates. In addition to fish, high salinity can also harm ectoparasites. Therefore, freshwater ectoparasites, such as those found in rivers and lakes, can thrive at low salinity (Herlina *et al*., 2019). Increased ammonia levels will increase parasite growth and density and worsen pond water quality, leading to decreased fish production. Generally, the range of ammonia concentrations in waters that ectoparasites can tolerate is 0.5-3.8 mg/L (Reda et al., 2024). This concentration is lower than the study's results, which reported ammonia concentrations of 0.0028-0.0080 mg/L. However, ammonia concentrations <0.3 mg/L are ideal for fish living in freshwater (Tuwitri *et al*., 2021). The optimal nitrate level for the growth and development of ectoparasites in freshwater is 0.008 mg/L and can still be tolerated at a concentration of 0.07 mg/L. Meanwhile, the optimal nitrite concentration for the growth and development of ectoparasites should not exceed 0.06 mg/L (Putri & Dewi, 2019).

Table 2. Water quality inspection results of Tanjung Bunga Lake, Makassar City

Parameter	West Point		South point		North Point		Standard SNI (2017)
Temperature (°C)	30 °C	29°C	29°C	30°C	30°C	30°C	27-30°C
pH	6	6	6	6	6	6	6-8
Salinitas (ppt)	0 ppt	0 ppt	0 ppt	0 ppt	0 ppt	0 ppt	0 ppt
Dissolve Oxygen (DO) (mg/L)	4,16	6,72	3,83	7,68	3,20	6,72	>5
Amonia (mg/L)	0,0049	0,0028	0,0080	0,0029	0,0038	0,0075	<0,3
Nitrate (mg/L)	0,0535	0,0241	0,0403	0,1849	0,0176	0,1772	<5
Nitrit (mg/L)	0,0535	0,0785	0,869	0,1849	0,0702	0,0660	<0,5

The main limitations of this study are that most of the koi fish samples were in healthy condition, only a small number showed clinical symptoms, the lack of comprehensive data on specific species of ectoparasites present, and the small number of ectoparasites obtained affected the use of statistical data processing. Further research is needed to identify these species at the molecular level to explore the potential relationship between the same species, which will later be used for prevention and treatment activities. Therefore, this study's results are essential for early detection, improving cultivation management, and eradicating ectoparasites that can cause stress, allowing secondary infections from other pathogens.

CONCLUSION

Based on the research results, it can be concluded that juvenile koi fish in Tanjung Bunga Lake, Makassar City, are infected with the ectoparasites *Myxobolus* sp., *Trichodina* sp., and *Dactylogyrus* sp. These ectoparasites cause health problems in juvenile koi fish, interfere with productivity, and damage the beauty of koi fish as freshwater ornamental fish. In addition, these ectoparasites can cause economic losses for koi.

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