Berkala **PENELITIAN HAYATI**

ISSN: 08526834 | E-ISSN:2337-389X

Volume 31 | No. 3 | **December** | 2025

Original article

Prevalence and intensity of ectoparasites in Nila Tilapia (*Oreochromis niloticus*) at BBI Babadan and BBI Bendogerit Blitar Regency

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Abstract

The availability of high-quality fish seeds is a key factor in the success of tilapia (*Oreochromis niloticus*) cultivation. The fry phase is particularly vulnerable to disease, especially ectoparasites that can inhibit fish growth. This study is a preliminary study aims to analyze the prevalence and intensity of ectoparasites in tilapia seeds at the Balai Benih Ikan (BBI) Babadan and the Balai Benih Ikan (BBI) Bendogerit, located at Blitar Regency. The fish samples used were 15 tilapia fish measuring 4-8 cm, which were taken randomly from each pond in each Fish Seed Center. Examination of ectoparasites in tilapia seeds (*O. niloticus*) was carried out on the surface of the fish's body, including external organs such as gills and fins, under a microscope at 100x magnification. The results of the study have found 11 species of ectoparasites in the BBI Babadan and 7 species of ectoparasites in the BBI Bendogerit. The level of *Trichodina* sp. parasite attack on tilapia in the Babadan BBI showed the highest prevalence, with a prevalence value of 100%. The *Apiosoma* sp. species at BBI Babadan exhibited the highest parasite intensity, with an intensity of 23 individuals. Water quality measurements at both BBIs showed pH and NH_3 levels exceeding the established limits, potentially causing stress and deteriorating fish condition. Sustainable management is essential to suppress parasitic infections and improve the quality of tilapia fry in cultivation.

Keywords: ectoparasites, intensit, nile tilapia, prevalence, water quality

Received: September 6, 2025 | Revised: November 12, 2025 | Accepted: December 14, 2025

Introduction

The need for food, such as animal protein, increases with population growth. Indonesia has abundant animal food resources, particularly fishery and marine products, due to its maritime status. In 2023, the national Fish Consumption Rate (AKI) was recorded at 57.61 kg/capita/year (KKP, 2025). Indonesian aquaculture production continues to increase, reaching 15 million tons per year in 2023 (BPS, 2025). Data shows that the demand for fish consumption in Indonesia exceeds the production. Furthermore, behind these promising figures, there are challenges that affect the sustainability and efficiency of production, particularly in the aquaculture sector. Fish farming is a crucial part of the fisheries sector, playing a crucial role in meeting these needs. Tilapia (*O. niloticus*) has become a major commodity in freshwater fish farming in Indonesia. Successful tilapia cultivation not only improves national food security but also serves as a source of community income (Dudung *et al.*, 2023).

The availability of high quality seeds is crucial for increasing tilapia cultivation productivity. The Fish Seed Center (BBI) is a government facility authorized to produce high quality fish seeds. BBI Babadan and BBI Bendogerit are two tilapia seed production facilities in Blitar Regency. Both BBI are under the auspices of the Blitar Regency Animal Husbandry and Fisheries Service. According to Yuliani *et al.* (2023), the seed stage is highly susceptible to disease. Therefore, maintaining fish health throughout the cultivation process, especially during the seeding phase, is crucial.

The success of the fish farming sector is greatly influenced by fish diseases. According to Dudung *et al.* (2023), there are three factors that disrupt the aquaculture ecosystem and cause diseases in fish: weak hosts (fish), pathogens, and poor environmental conditions. Parasitic attacks are the most common problem among the various types of diseases that affect fish, especially fry phase. Parasites are organisms that live in other organisms and usually harm their hosts (Handayani, 2020). The presence of parasites can lead to a decline in fish quality, growth, and production, which may result in interrelated economic losses ranging from fry provision to fish marketing (Sanggita *et al*., 2023).

The physiological condition of fish and the dynamics of parasite populations in aquatic environments are strongly influenced by environmental factors, particularly water quality. Water quality is crucial for fish farming because if it does not meet requirements, the aquatic environment can lead to disease. Ideal water conditions must be maintained to keep fish healthy, stress-free, and less susceptible to disease or parasite infection (Siegers *et al.*, 2024). Inadequate environmental quality, such as dirty pond water, low temperatures, low oxygen levels, and high ammonia levels, is among the factors that can weaken the immune system in fish, making them more susceptible to disease (Afrianto *et al.*, 2015).

An initial survey at the BBI Babadan in Blitar Regency indicated that monitoring of diseased fish fry was

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http://dx.doi.org/10.23869/bphjbr.31.3.20256

being conducted by separating the fish into small ponds. However, at the BBI Bendogerit has not yet conducted any monitoring of seriously infected fish. This situation requires close attention, as if left untreated, it could lead to a decline in fish fry production. Information regarding the level of parasite infestation that commonly affects freshwater fish at the BBI Bendogerit and BBI Babadan in Blitar Regency is still limited. Furthermore, efforts to screen for parasitic infections in tilapia fry at both hatcheries are also minimal.

Based on the problem description above, this study is a preliminary study aims to analyze the prevalence and intensity of ectoparasites *O. niloticus*. This research will focus on two BBI located in Blitar Regency, the BBI Babadan and BBI Bendogerit. This study provides a preliminary comparison of ectoparasite infestation levels in *O. niloticus* in two BBI in Blitar Regency, which aims to describe existing conditions and identify potential factors that may affect hatchery performance. This information can be used to develop better management strategies to improve the health and productivity of tilapia in fish hatcheries.

Methods

Time and Location

This research was conducted from March to May 2025 at the Blitar Regency Fish Health and Aquaculture Environment Laboratory. Sampling locations were the BBI Babadan and the BBI Bendogerit located in Blitar Regency.

Sample Collection

Sampling was conducted three times to optimize time efficiency and maintain consistent tilapia conditions between samples. The samples consisted of 15 tilapia measuring 4-8 cm taken directly from nursery ponds at the BBI Babadan and BBI Bendogerit in Blitar Regency. The fish were then placed in bags filled with water and oxygen and transported to the Blitar Regency Fish Health and Aquaculture Laboratory for ectoparasite examination.

Water sampling was conducted directly using 100 ml Schott bottles, concurrently with the collection of *O. niloticus* from the BBI Babadan and BBI Bendogerit in Blitar Regency.

Examination of Ectoparasites

Ectoparasites examination of *O. niloticus* is performed on the surface of the fish, including external organs such as the gills and fins. According to Kabata (1985) in Handayani (2020), parasite examination in fish can be performed by opening the fish's operculum and cutting the gills with scissors. Fin examination involves cutting the fins with scissors. The pieces are flattened using tweezers and placed on a slide. The sample is then dripped with distilled water. Afterward, the slide is covered with a coverslip, and the results are viewed under a microscope at 100x magnification.

The examination of *O. niloticus*) samples is followed by the identification of ectoparasites by comparing the results of the ectoparasite findings with references from the books "Fish Parasites" by Patrick T. K. Woo and "Fish Disease" by Edward J. Noga.

Measurement of Water Quality

Water quality was assessed by measuring pH, DO, NH_3, NO_2, and NO_3 levels in each *O. niloticus* pond at each BBI. pH measurements were performed using a pH meter. DO, NH_3, NO_2, and NO_3 parameters were measured using the SERA aqua-test kit, then matched against the color chart provided in the test kit instructions.

Data Analysis

The data obtained were then analyzed descriptively and quantitatively. Data analysis to calculate the level of parasite infestation involved calculating prevalence and intensity. According to Kabata (1985) in Abdan *et al.* (2023), the prevalence and intensity of parasite infection can be calculated using the formula:

$$\text{Prevalence} = \frac{\sum \text{Infected fish}}{\sum \text{Sample fish}} \times 100\%$$

$$\text{Intensity} = \frac{\sum \text{Parasites founded}}{\sum \text{Infected fish}}$$

According to William and Bunkley-Williams (1996) in Abdan *et al.* (2023), the categories of intensity and prevalence levels of ectoparasite infections are presented in Table 1 and Table 2.

Table 1. Criteria for the prevalence of parasite infection

No.	Categories	Prevalence (%)	Notes
1.	Always	99–100	Very severe infection
2.	Almost Always	90–98	Severe infection
3.	Usually	70–89	Intermediate infection
4.	Frequently	50–69	Very frequent infection
5.	Commonly	30–49	Normal infection
6.	Often	10–29	Frequent infection
7.	Occasionally	1–9	Gradual infection
8.	Rarely	< 0.1–1	Rare infection
9.	Very Rarely	< 0.01–0.1	Very rare infection
10.	Almost Never	< 0.01	Almost no infection

Table 2. Parasites infection intensity criteria

No	Categories	Intensity (ind/fish)
1.	Very light	< 1
2.	Light	1 – 5
3.	Moderate	6 – 55
4.	Heavy	56 – 100
5.	Very heavy	>100
6.	Superinfection	>1000

Results and Discussion

Water Quality of BBI Babadan and BBI Bendogerit, Blitar Regency

Table 3 presents comparative data on water quality in ponds at Babadan and Bendogerit BBI. Both locations had adequate DO and NO_2 values. However, the NH_3, NO_3, dan pH parameters showed different results. The pH value at Bendogerit BBI was higher than at Babadan BBI. The NH_3 value at Babadan BBI exceeded the recommended ammonia limit.

Table 3. Comparison of water quality results at BBI Babadan and BBI Bendogerit

Water Quality Parameters	Measurement results		Optimal Water Quality
	Babadan	Bendogerit	
DO (ppm)	6	6	>4 (SNI 7550:2009)
pH	8.70	9.22	6.5-8.5 (SNI 7550:2009)
NH_3 (ppm)	0.08	0	<0.02 (SNI 7550:2009)
NO_2 (ppm)	0	0	<0.06 (PP Nomor 22 Tahun 2021)
NO_3 (ppm)	0.6	0	<20 (PP No.22 Tahun 2021)

Based on Table 3, the water quality at BBI Babadan and BBI Bendogerit exhibits several parameters that differ significantly for tilapia growth. In the Dissolved Oxygen (DO) parameter, both locations have the same level of 6 ppm. This result meets the requirements according to SNI 7550:2009; however, according to Lamangkaraka *et al.* (2024), the optimal DO value for tilapia growth is 7 ppm. The ideal water pH value for optimal growth and reproduction for tilapia is around 7-8 (Indriati & Hafiludin, 2022). However, the results of the study showed that the pH values of both BBI still exceeded the requirements. Yuliani *et al.* (2023) stated that the high water pH value was likely caused by inadequate water exchange, which caused leftover feed and fish waste to accumulate at the bottom of the pond, thereby increasing the pH value. The ammonia (NH_3) level at BBI Babadan exceeded the requirements limit, which was more than 0.02 ppm. Slightly high pH values and ammonia (NH_3) concentrations exceeding the recommended limits in BBI Babadan can trigger stress in fish. Stressed fish tend to have weakened immune systems, making them more susceptible to parasite attacks (Madyowati & Muhajir, 2018).

In general, water quality is a crucial environmental factor in fish farming. Parameters such as temperature, pH, dissolved oxygen (DO), ammonia (NH_3), nitrite (NO_2), and nitrate (NO_3) must be within the optimal range for fish to grow healthily and avoid physiological stress. Air quality plays a crucial role in fish farming, particularly for fish health. Decreased air quality can trigger disease and affect fish survival and growth (Cahyani *et al.*, 2023). According to Afrianto *et al.* (2015), inadequate environmental quality, such as dirty pond water, low temperature, low oxygen levels, and high ammonia levels, is among the factors that can weaken the immune system in fish, making them more susceptible to disease.

Ectoparasites in Tilapia in BBI Babadan and BBI Bendogerit, Blitar Regency

Based on the results of observations that have been carried out on 15 tilapia from BBI Babadan and BBI Bendogerit, a total of 11 types of ectoparasites have been found that infect the fish. We found 11 types of ectoparasites in BBI Babadan, and 7 types in BBI Bendogerit. The results of the observations show that the types of parasites that infect tilapia include *Trichodina* sp., *Dactylogyrus* sp., *Chilodonella* sp., *Oodinium* sp., *Ichthyophthirius multifiliis*, *Ambiphrya* sp., *Apiosoma* sp., *Riboscyphidia* sp., *Gyrodactylus* sp., *Epistylis* sp., dan *Costia* sp.. The diversity of parasites obtained during the observations can be seen in Figure 1.

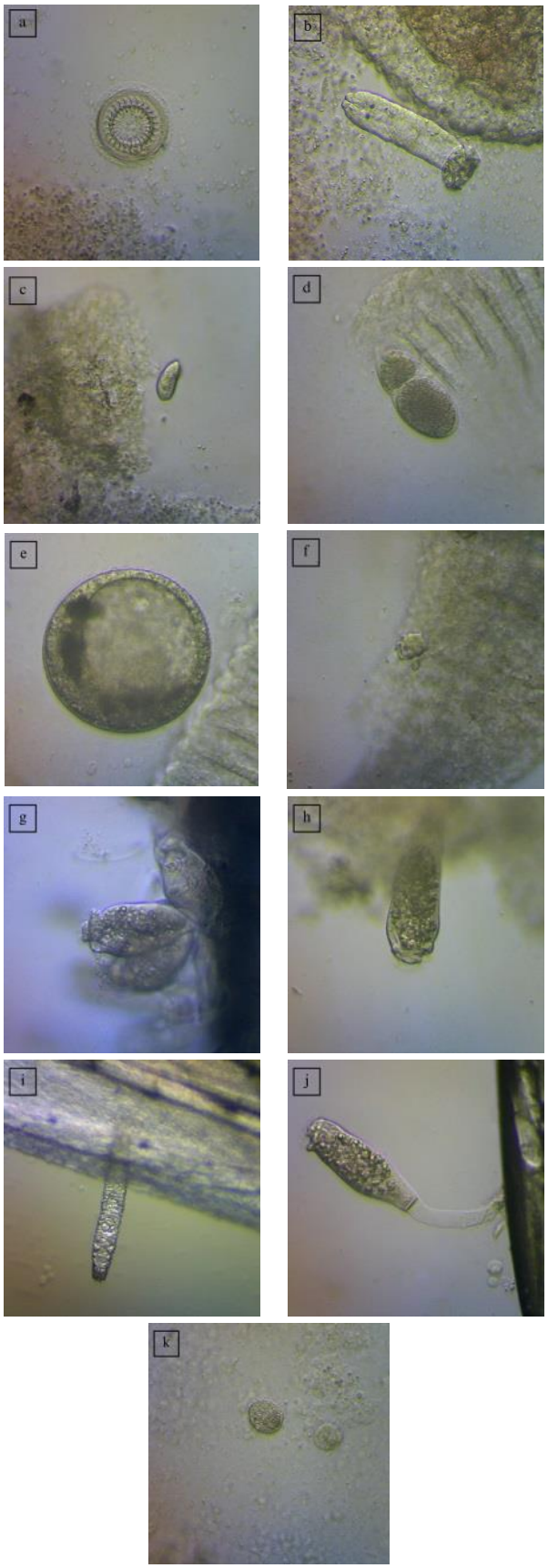

Fig. 1. Types of ectoparasites found at 100× magnification (a) *Trichodina* sp.; (b) *Dactylogyrus* sp.; (c) *Chilodonella*; (d) *Oodinium* sp.; (e) *Ichthyophthirius multifiliis*; (f) *Ambiphrya*; (g) *Apiosoma*; (h) *Riboscyphidia* sp.; (i) *Gyrodactylus* sp.; (j) *Epistylis* sp.; (k) *Costia*

Ectoparasites that attack fish generally come from the crustacean group, worms (including nematodes, trematodes, and cestodes), and protozoa. These parasites usually infest the external parts of the fish's body, such as the fins, scales, *operculum*, and gills (Roeswandono *et al.*, 2021). Based on several studies, several types of ectoparasites have been found on the gills, fins, and skin of tilapia, including the protozoan *Trichodina* sp. and the monogean *Dactylogyrus* sp. (Putra *et al.*, 2018).

Intensity of Ectoparasites in Tilapia at BBI Babadan and BBI Bendogerit, Blitar Regency

The results of the calculation of ectoparasite intensity in tilapia at BBI Babadan are presented in Table 4. The results showed that most parasite species had intensity with various categories. It can be seen in Table 4. Ectoparasite infections in 6 species were indicated as moderate category, while the other 5 species were indicated as light category. *Apiosoma* sp. species had the highest intensity of 23 individuals/fish. The lowest intensity was found in 3 species, namely *Chilodonella* sp., *Riboscyphidia* sp., and *Costia* sp., with a value of 1 individual/fish.

The results of the calculation of ectoparasite intensity in tilapia at BBI Bendogerit are presented in Table 5. The results showed that all parasite species found showed infection intensity in the light category.

Table 4. Intensity of ectoparasites in Tilapia at BBI Babadan

No	Types of Ectoparasites	Number of Infected Fish (fish)	Number of Ectoparasites (individual)	Intensity (Ind/fish)	Categories
1	*Trichodina* sp.	15	143	9.53	Moderate
2	*Dactylogyrus* sp.	13	133	10.23	Moderate
3	*Chilodonella* sp.	2	2	1	Light
4	*Oodinium* sp.	8	66	8.25	Moderate
5	*Ichthyophthirius multifiliis*	7	70	10	Moderate
6	*Ambiphrya* sp.	1	5	5	Light
7	*Apiosoma* sp.	2	46	23	Moderate
8	*Riboscyphidia* sp.	1	1	1	Light
9	*Gyrodactylus* sp.	4	11	2.75	Light
10	*Epistylis* sp.	1	6	6	Moderate
11	*Costia* sp.	1	1	1	Light

Table 5. Intensity of ectoparasites in Tilapia at BBI Bendogerit

No	Types of Ectoparasites	Number of Infected Fish (fish)	Number of Ectoparasites (individual)	Intensity (Ind/fish)	Categories
1	*Trichodina* sp.	10	15	1.5	Light
2	*Dactylogyrus* sp.	9	21	2.33	Light
3	*Oodinium* sp.	3	17	5.67	Light
4	*Ichthyophthirius multifiliis*	4	7	1.75	Light
5	*Riboscyphidia* sp.	3	6	2	Light
6	*Gyrodactylus* sp.	4	4	1	Light
7	*Costia* sp.	2	4	2	Light

Based on Table 4 and Table 5, it can be seen that the intensity of parasite infection in BBI Babadan tends to be higher than in BBI Bendogerit. This is in accordance with Alifuddin *et al.* (2013) in Tarigan *et al.* (2024), who stated that the longer the host is exposed to parasites and the larger the surface area of the fish's body, the more parasite colonies will form, so that the intensity value will increase. In the results, the intensity of the *Apiosoma* sp. has the highest value, namely 23 individuals/fish. This is because in the test we found 46 individuals, and of the 15 samples, only 2 were infected with this type of parasite. Therefore, the intensity value is higher than the other species.

Among the various fish parasites, the sessiline ciliated protozoa, such as *Apiosoma*, *Scopulata*, *Ambiphrya*, and *Epistylis*, are the most dangerous and frequently cause disease in fish farming (El-Tantawy *et al.*, 2013). These parasites are often found attached to the gills and body surfaces of aquatic organisms, especially freshwater fish fry (Li et al., 2008). According to Petty *et al.* (2022), fish infected with these parasites generally show symptoms of excess mucus production, frequent rubbing of the body against surrounding objects (flashing), swimming at the surface to obtain oxygen (piping), and loss of condition.

Moderate infection of the *Apiosoma* sp. parasite in small fish can be fatal because it can cause a reduction in appetite in fish, which ultimately leads to death (El-Tantawy *et al.*, 2013). According to Li *et al.* (2016), *Apiosoma* parasite infection in host fish depends on two main factors, namely the condition of the air environment and the health of the host fish itself. When the host fish is in a healthy condition, *Apiosoma* infection can generally be well controlled so that the impact on the fish's body is relatively small or even nonexistent. However, if the condition of the host fish is poor and is exacerbated by an unfavorable air environment, the *Apiosoma* population can breed massively on the surface of the fish, causing more serious impacts (Li *et al.*, 2016).

Prevalence of Ectoparasites in Tilapia at BBI Babadan and BBI Bendogerit, Blitar Regency

Table 6 presents the results of the calculation of ectoparasite prevalence in tilapia at BBI Babadan. The results indicate that 11 ectoparasite species were found infecting fish seed samples with various categories. The highest

prevalence value was obtained by *Trichodina* sp. with a prevalence of 100%, indicating that all test samples were infected with this parasite. The lowest prevalence refers to four species, *Ambiphrya* sp., *Riboscyphidia* sp., *Epistylis* sp., and *Costia* sp., with a prevalence value of 6.67%.

Table 7 shows the results of the calculation of ectoparasite prevalence in tilapia at the BBI Bendogerit. Five species of ectoparasites that attacked were still in the "often" category, while two species, *Trichodina* sp. and *Dactylogyrus* sp., were included in the "frequently" category.

Table 6. Prevalence of ectoparasites in Tilapia at BBI Babadan

No	Types of Ectoparasites	Number of Infected Fish (fish)	Prevalence (%)	Categories
1	*Trichodina* sp.	15	100	Always
2	*Dactylogyrus* sp.	13	86.67	Usually
3	*Chilodonella*	2	13.33	Often
4	*Oodinium* sp.	8	53.33	Frequently
5	*Ichthyophthirius multifiliis*	7	46.67	Commonly
6	*Ambiphrya* sp.	1	6.67	Occasionally
7	*Apiosoma* sp.	2	13.33	Often
8	*Riboscyphidia* sp.	1	6.67	Occasionally
9	*Gyrodactylus* sp.	4	26.67	Often
10	*Epistylis* sp.	1	6.67	Occasionally
11	*Costia* sp.	1	6.67	Occasionally

Table 7. Prevalence of ectoparasites in Tilapia at BBI Bendogerit

No	Types of Ectoparasites	Number of Infected Fish (fish)	Prevalence (%)	Categories
1	*Trichodina* sp.	10	66.67	Frequently
2	*Dactylogyrus* sp.	9	60	Frequently
3	*Oodinium* sp.	3	20	Often
4	*Ichthyophthirius multifiliis*	4	26.67	Often
5	*Riboscyphidia* sp.	3	20	Often
6	*Gyrodactylus* sp.	4	26.67	Often
7	*Costia* sp.	2	13.33	Often

Based on the results presented, it can be seen that the level of parasite infection in fish fry in Babadan BBI tends to be higher than in Bendogerit BBI. Some species, such as *Chilodonella* sp., *Ambiphrya* sp., *Apiosoma* sp., and *Epistylis* sp., were not found at all in BBI Bendogerit, with a prevalence value of 0%. BBI Babadan showed a higher prevalence and intensity of ectoparasites and also had several suboptimal water quality parameters.

In this study, the BBI Babadan showed a higher prevalence of ectoparasites than the BBI Bendogerit. The *Trichodina* sp. species in the BBI Babadan had a prevalence of 100%, while in the BBI Bendogerit the prevalence was 66.67%. According to Durborow (2003) in Febriani *et al.* (2024), *Trichodina* sp. is a parasite that can infect almost all fish species, both those living in freshwater and saltwater. Tilapia that are approximately four months old are susceptible to this type of parasite; this is because the fish are experiencing a decrease in their immune system due to stress when transferred from the old pond to the new pond (Wardani, 2021). According to Atma *et al.* (2025), factors that can influence infection of this species are the presence of fish of different ages in one pond and high fish density. This condition has the potential to cause the spread of diseases, including parasitic diseases, from one fish to another.

Fish infected with the *Trichodina* sp. parasite will show symptoms such as a weakened body, a dull and pale body color, excessive mucus production, and decreased appetite, resulting in less than optimal fish weight (Sanggita *et al*., 2023). According to Yuliani *et al.* (2023), severe *Trichodina* sp. parasite infection can damage the fish's body. This damage is characterized by wounds on the epithelial cells of the fish's skin, causing irritation. The possibility of injury to fish occurs because the *Trichodina* sp. parasite has blade denticles that resemble serrations. This part protrudes on *anterior* side and tapers on the *posterior* side of the blade, so it can injure the fish's skin (Nofyan *et al*., 2015).

Fish under stress are one of the factors that make them more susceptible to parasites, due to a weakened immune system. Factors that can influence stress in fish include changes in temperature, changes in water quality, high population density, and unstable environmental conditions (Rosita *et al.*, 2024). Increased ammonia levels are also a contributing factor to stress in fish. Water temperature, pH, and dissolved oxygen concentration influence ammonia toxicity (Larasati *et al.*, 2020). According to Eissa *et al.* (2011) in Prianggara *et al.* (2016), high ammonia levels in water can increase the prevalence of protozoan infections and weaken fish's immune systems, making them susceptible to parasite infections.

Several empowerment management strategies for tilapia cultivation are needed to address this ectoparasite problem. Separating sick fish into special ponds is also an option, because according to Irianto (2005) in Manurung & Gaghenggang (2016), parasitic infections spread easily in fish populations with high rates of contact between sick and healthy fish, increasing the likelihood of transmission.

This study serves as preliminary research due to the the small number of facilities observed and the lack of controlled environmental variables. The results may lead to further research involving correlation analysis between ectoparasite infestation and environmental conditions.

Conclusion

Based on the results, 11 ectoparasite species were found that attacked tilapia at the BBI Babadan and 7 ectoparasite species that attacked tilapia at the BBI Bendogerit. The highest prevalence of ectoparasite species in tilapia in both BBIs was *Trichodina* sp., with a value of 100%, and was included in the "Always" infection level category. The highest intensity of ectoparasite species in tilapia fry in both BBIs was *Apiosoma* sp., with a value of 23 individuals/fish, and was included in the "Moderate" infection level category. The pH parameters of both BBIs exceeded the required limits. In the NH_3 parameter, BBI Babadan had a value that exceeded the required limits

Acknowledgment

The authors expressed gratitude to the Department of Animal Husbandry and Fisheries of Blitar Regency and the Fish Health and Aquaculture Environment Laboratory of Blitar Regency, as well as the BBI Babadan and the BBI Bendogerit, for facilitating the implementation of this research.

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