

## Immersion of betel leaf extract (*Piper betle* L.) against ectoparasite on gourami (*Osphronemus gouramy*)

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### Abstrak

Infeksi ectoparasit sering menyerang ikan gurami pada fase benih. Perendaman ekstrak daun sirih dapat menjadi salah satu bahan alami yang dapat jadi alternatif untuk menurunkan serangan infeksi ectoparasit. Penelitian ini bertujuan untuk mengetahui dan menganalisis tingkat prevalensi dan intensitas ectoparasit yang menyerang benih ikan gurami. Rancangan penelitian menerapkan 4 perlakuan dengan 3 kali ulangan. Perlakuan P1 (kontrol), perlakuan P2 (ekstrak daun sirih 150 mg/L<sub>air</sub>), perlakuan P3 (ekstrak daun sirih 200 mg/L<sub>air</sub>), dan perlakuan P4 (ekstrak daun sirih 250 mg/L<sub>air</sub>). Hasil penelitian menunjukkan bahwa perlakuan P3 dapat menurunkan tingkat prevalensi tertinggi pada ectoparasit *Trichodina* sp. (40%) dan *Dactylogyrus* sp. (53%) dan tingkat kelangsungan hidup sebesar 90%. Perlakuan P4 dapat menurunkan tingkat prevalensi *Gyrodactylus* sp. sebesar 20%, serta intensitas parasit *Trichodina* sp. (5 ind/ekor), parasit *Gyrodactylus* sp. (1 ind/ekor) dan *Dactylogyrus* sp. (2 ind/ekor). Namun, pertumbuhan panjang, bobot mutlak benih ikan dan FCR tidak berpengaruh secara signifikan. Ada 3 jenis ectoparasit yang menyerang benih ikan gurami yaitu *Trichodina* sp. (prevalensi 40%, intensitas 5 ind./ekor), *Gyrodactylus* sp. (prevalensi 20%, intensitas 1 ind/ekor), *Dactylogyrus* sp. (prevalensi 53%, intensitas 2 ind/ekor).

Kata Kunci: Bahan alami, *Dactylogyrus* sp, infeksi, intensitas, prevalensi

### Abstract

Ectoparasite infections frequently affect gourami fish during the seed (juvenile) phase. Immersion in piper betle extract can be a natural alternative treatment to reduce ectoparasite infections by utilizing its bioactive compounds. This study aims to identify and analyze the prevalence and intensity of ectoparasite infecting juvenile gourami. The experimental design consisted of four treatments with three replications each. Treatment P1 (control), treatment P2 (piper betle extract at 150 mg/L), treatment P3 (piper betle extract at 200 mg/L), and treatment P4 (piper betle at 250 mg/L). The findings indicated that treatment P3 was the most effective in reducing the prevalence of *Trichodina* sp. (40%) and *Dactylogyrus* sp. (53%), and also achieved a survival rate of 90%. Treatment P4 was able to reduce the prevalence of *Gyrodactylus* sp. by 20%, as well as the *Trichodina* sp. (%), *Gyrodactylus* sp. (%), and *Dactylogyrus* sp. (%). However, the growth in length, absolute weight gain, and feed conversion ratio (FCR) were not significantly affected. The types of ectoparasite were found to infect juvenile gourami: *Trichodina* sp. (prevalence 40% and intensity 5 ind/fish), *Gyrodactylus* sp. (prevalence 20% and intensity 1 ind/fish), and *Dactylogyrus* sp. (prevalence 53% and intensity 2 ind/fish).

Keywords: Natural ingredients, *Dactylogyrus* sp., infection, intensity, prevalensi

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### Highlights

- Juvenile gourami fish are primarily affected by the parasite *Trichodina* sp..
- Immersion of betel leaf extract can decrease the incidence of *Dactylogyrus* sp., *Gyrodactylus* sp., and *Trichodina* sp. on gourami larvae.
- Immersion of betel extract at 200 mg/L increased the survival rate of juvenile gourami.

## **Introduction**

The gourami fish (*Osphronemus gouramy*) is a type of freshwater fish with high economic value however the production rate is still insufficient to meet market demand (Effendi et al. 2006; Sulistyono et al. 2016). One of the factors contributing to decreased productivity in fish farming is ectoparasite infections (Conchita et al. 2023). In fish farming, ectoparasites are a major issue that can disrupt the growth and health of the fish (Dastin et al. 2021). Ectoparasites that frequently infect gourami fish include *Trichodina* sp., *Chilodonella* sp., *Ichtyobodo* sp., *Miscrosporadia*, *Carchesium granulatum*, *Cichligogyrus* sp., *Dactylogyrus* sp., *Centrocestus* sp., *argulus* sp., *lerneae* sp., *Ganatia* sp. and *hastchekia* sp. (Dastin et al. 2021; Gayatri et al. 2024; Rahmah et al. 2024). Ectoparasites often attack the fins, skin, and gills, specifically in the study by Sunarto (2019) it was reported that the parasite *Trichodina* sp. was identified infecting the fins, gills, and skin. This leads to a decrease in the fish's appetite (Hairunnisa et al. 2021) and can cause bleeding or even death in the fish (Agustina et al. 2019).

The use of chemicals in aquaculture can result in negative impacts on the water environment, therefore the use of natural materials becomes an option for aquaculture activities as an environmentally friendly alternative. Piper betle are known as a natural material with potential for combating ectoparasite infections, thanks to their active compounds that possess antiparasitic properties (Mufidah, 2021). These compounds include steroids, tannins, saponins, alkaloids, flavonoid, and essential oil which are naturally found in piper betle (Rukmini et al. 2020). The aim of this study is to determine and analyze the prevalence and intensity of ectoparasites infecting juvenile gourami.

## **Method**

### **Date and location**

This study was conducted from November 6, 2024 to April 2025, at the Aquatic Laboratory, Study Program of Aquaculture and Biology Laboratory in Djuanda University.

### **Equipment and materials**

Juvenile gourami fish measuring 2-3 cm from Ciseeng District, Bogor Regency, were used as test subjects. The materials used included methanol solution, distilled water, tissue paper and piper betle extract, while the equipment used consisted of aquariums, binocular microscopes, pH meters, DO meters, thermometers, spectrophotometers, beakers, microscope slides, cover glasses, rulers, dropper pipettes, and surgical instruments.

### **Ectoparasite identification**

Ectoparasite identification was performed by scraping mucus from the fish's body surface and gills using a scalpel, then placing it on a microscope slide and adding a drop of distilled water. The sample was then covered with a cover slip and observed under a microscope to identify the ectoparasites.

### **Piper betle extraction**

Fresh piper betle are washed, dried, and then ground into a fine powder. Extraction is performed by dissolving 8 grams of piper betle powder in 80 mL of distilled water, then heating it at 90°C for 30 minutes using a water bath, the mixture is then cooled to a warm temperature to allow it to be mixed with the piper betle powder (Voigt, 1984). The solution is stirred regularly and left for 24 hours. The resulting infusion is then filtered using Whatman No. 42 paper to separate the undissolved particles.

### **Experimental design**

The experimental design consisted of four treatment: P1 (control), P2 (piper betle extract at a dose of 150 mg/L), P3 (piper betle extract at a dose of 200 mg/L), P4 (piper betle extract at a dose of 250 mg/L<sub>air</sub>), with each treatment repeated three times.

### **Water quality**

Water samples were collected for water quality analysis, with water temperature and pH measured on-site, while dissolved oxygen and total ammonia were analyzed at the Fisheries Laboratory of Djuanda University, Bogor.

### **Prevalence and Intensity**

According to Kabata (1985), the prevalence and intensity levels in fish are calculated using the following formula:

$$\text{Prevalence} = \frac{\text{Number of infected sample fish}}{\text{Number of sample fish examined}} \times 100\%$$

$$\text{Intensity} = \frac{\text{Number of parasite found}}{\text{Number of infected fish}}$$

### **Absolute weight gain**

The calculation was performed using the formula from Zonneveld et al. (1991) as follows:

$$W \text{ (g)} = W_t - W_0$$

Explanation:

W = Absolute weight gain (gram)

W<sub>t</sub> = Average weight at the end of the experiment (gram)

W<sub>0</sub> = Average weight at the beginning of the experiment (gram)

### **Absolute length gain**

The calculation was performed using the formula from Zonneveld et al. (1991) as follows:

$$L = L_t - L_0$$

Explanation:

L = Absolute length growth (cm)

L<sub>t</sub> = Average length at the end of the experiment (cm)

L<sub>0</sub> = Average length at the beginning of the experiment (cm)

### **Survival rate (SR) and Food conversion ratio (FCR)**

The calculation was performed using the formula from Huissman (1987) as follows:

$$\text{SR \%} = \frac{N_t}{N_0} \times 100\%$$

Explanation:

SR = *Survival rate* (%)

N<sub>t</sub> = Number of fish alive at the end of the experiment (tail)

N<sub>0</sub> = Number of fish alive at the beginning of the experiment (tail)

The calculation was performed using the Effendie (2002) formula:

$$FCR = \frac{F}{(W_t + D) - W_0}$$

Explanation:

FCR = Food conversion ratio

F = Amount of feed provided (gram)

W<sub>t</sub> = Fish biomass weight at the end of the experiment (gram)

W<sub>0</sub> = Fish biomass weight at the beginning of the experiment (gram)

D = Fish biomass weight of fish that died during the experiment (gram)

### Data analysis

The data from the observations on the prevalence and intensity of each parasite were statistically analyzed using ANOVA (*Analysis of Variance*). If there is a significant difference a Duncan post-hoc test will be conducted with a 95% confidence level. Water quality data were analyzed descriptively.

## Results and discussion

### Preliminary study

The observations revealed three species of ectoparasite that infected the juvenile gourami fish, several ectoparasite species found in the culture ponds include *Dactylogyrus* sp., *Gyrodactylus* sp., and *Trichodina* sp..

### Prevalence

Out of a total of 15 juvenile gourami observed 93% were infected with the parasite *Trichodina* sp.. Juvenile fish infected with *Gyrodactylus* sp. accounted for 66%. Meanwhile the parasite *Dactylogyrus* sp. was found infecting 80% of the sample juvenile fish (Figure 1).

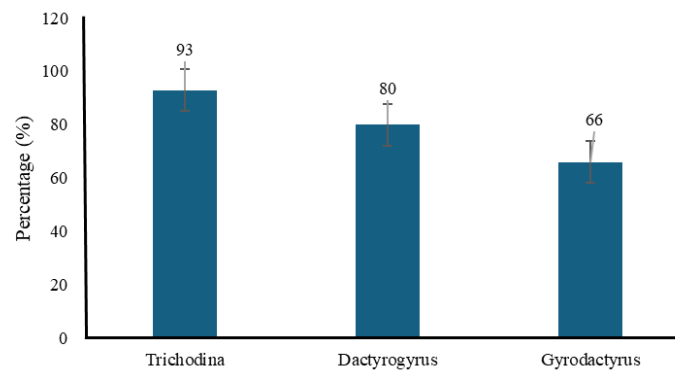


Figure 1. Prevalence of ectoparasites

Based on Figure 1 the most dominant parasite infecting juvenile gourami was *Trichodina* sp. found in 14 fish. Meanwhile the lowest parasite infection was caused by *Gyrodactylus* sp. found in 10 fish. Ectoparasite infections in juvenile gourami can be classified based on their frequency as very frequent, occasional, and persistent.

### Intensity

The results showed that *Trichodina* sp. infected juvenile gourami at a rate of 18 individuals. Juvenile gourami infected with *Gyrodactylus* sp. had an average of three on each of fish. While *Dactylogyrus* sp. was found infecting at a rate of five individual on each fish (Figure 2).

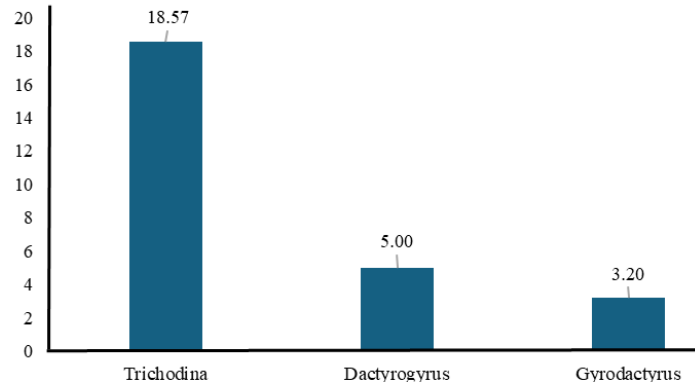


Figure 2. Intensity of ectoparasites

Figure 2 shows that *Trichodina* sp. had the highest intensity of infection with 18 ind/ekor and while *Gyrodactylus* sp. had the lowest intensity with 3 ind/ekor. The ectoparasite infecting juvenile gourami can be categorized into low and moderate infection levels.

### Primary research

#### Prevalence

##### 1. *Trichodina* sp.

The study showed a significant difference ( $P < 0,05$ ), with the prevalence of *Trichodina* sp. on juvenile gourami treated with different concentrations of piper betle extract as presented in Figure 3.

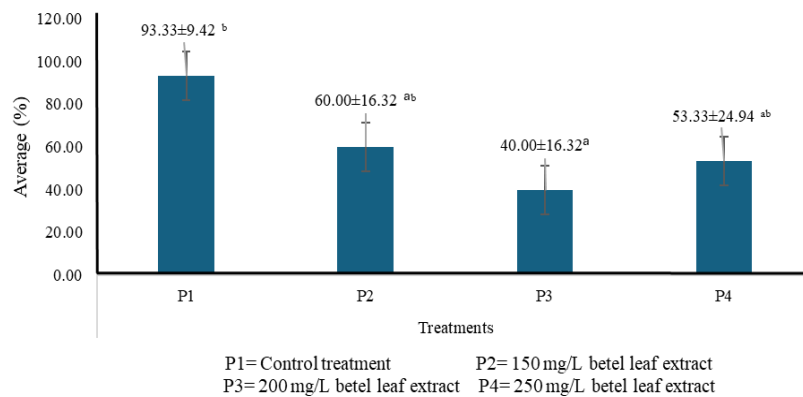


Figure 3. Prevalence of *Trichodina* sp.

Based on the results shown in Figure 3, it can be seen that P3 (piper betle extract at 200 mg/L) was the treatment with the greatest reduction in prevalence and while P1 (control) was the treatment with the lowest reduction in *Trichodina* sp. prevalence.

##### 2. *Gyrodactylus* sp.

The research results showed that soaking with piper betle extract resulted in a significant difference ( $P < 0,05$ ) in the *Gyrodactylus* sp. parasite infecting juvenile gourami (Figure 4).

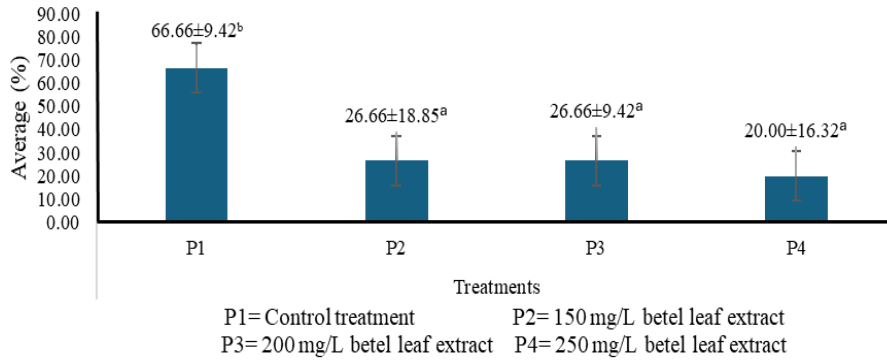


Figure 4. Prevalence of *Gyrodactylus* sp.

Figure 4 shows that P4 (*Piper betle* extract at 250 mg/L) was the most effective treatment and while P1 (control) was the treatment with the lowest reduction in *Gyrodactylus* sp. prevalence.

### 3. *Dactylogyrus* sp.

Soaking with piper betle extract at different doses in each treatment showed no significant results ( $P > 0,05$ ) on the prevalence of *Dactylogyrus* sp. infecting juvenile gourami (Figure 5).

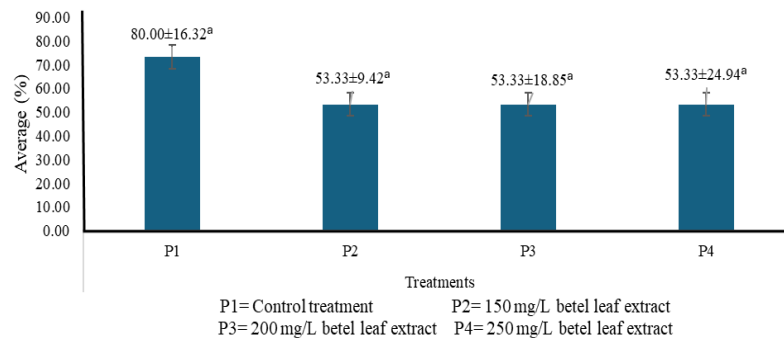


Figure 5. Prevalence of *Dactylogyrus* sp.

Based on Figure 5 it explains that the prevalence of *Dactylogyrus* sp. showed the same results in three treatment regarding the reduction in the prevalence of *Dactylogyrus* sp..

## Intensity

### 1. *Trichodina* sp.

Based on the statistical test using the Duncan method, there was a significant difference in the intensity of *Trichodina* sp. between treatment P1 and P2, P3 and P4 ( $P < 0,05$ ; Figure 6).

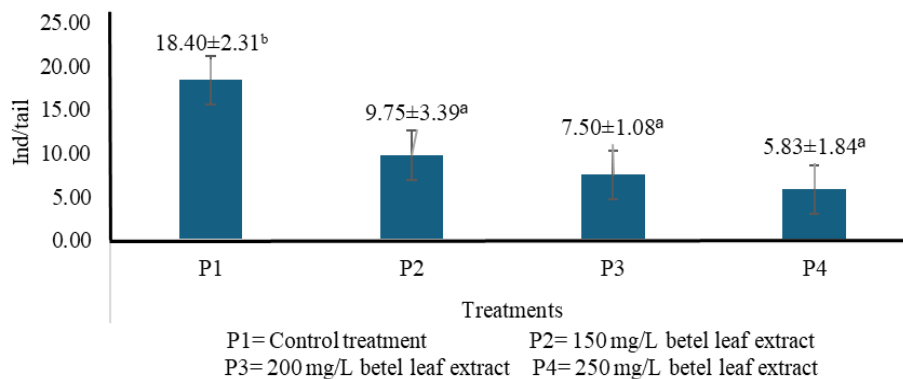


Figure 6. Intensity of *Trichodina* sp.

Figure 6 shows that P4 (*Piper betle* extract at 250 mg/L) was the treatment with the best reduction in intensity.

## 2. *Gyrodactylus* sp.

Based on the statistical test using the Duncan method, there was a significant difference in the intensity of *Gyrodactylus* sp. between P1 and P2, P3 and P4 ( $P < 0,05$ ; Figure 7).

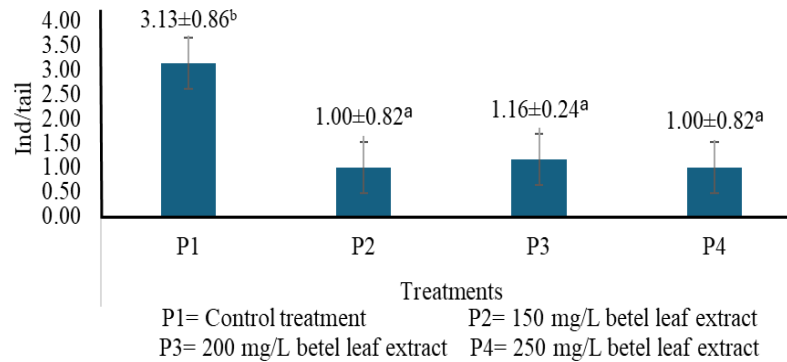


Figure 7. Intensity of *Gyrodactylus* sp.

Based on Figure 7 two treatment showed the same intensity reduction namely P2 (piper betle extract at 150 mg/L) and P4 (piper betle extract at 250 mg/L). Meanwhile the Duncan's post-hoc test showed a significant difference in the intensity of *Gyrodactylus* sp. between P1 and P2, P3 and P4.

## 3. *Dactylogyrus* sp.

The analysis results showed no significant difference between treatment ( $P > 0,05$ ; Figure 8) regarding the intensity of *Dactylogyrus* sp..

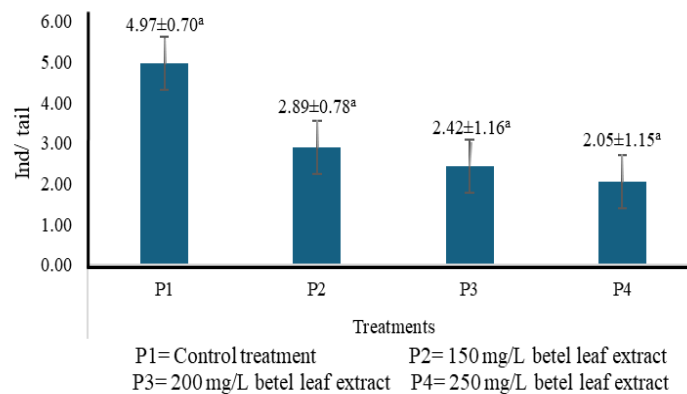


Figure 8. Intensity of *Dactylogyrus* sp.

Based on figure 13 the results show that the intensity of *Dactylogyrus* sp. did not differ significantly, but there was a decrease in intensity after soaking, P4 (piper betle extract at 250 mg/L) was the treatment with the greatest reduction in *Dactylogyrus* sp. intensity and while P1 (control) had the lowest reduction in intensity.

## Absolute weight growth

The analysis of variance showed no significant differences across all treatment ( $P > 0,05$ ; Figure 9).

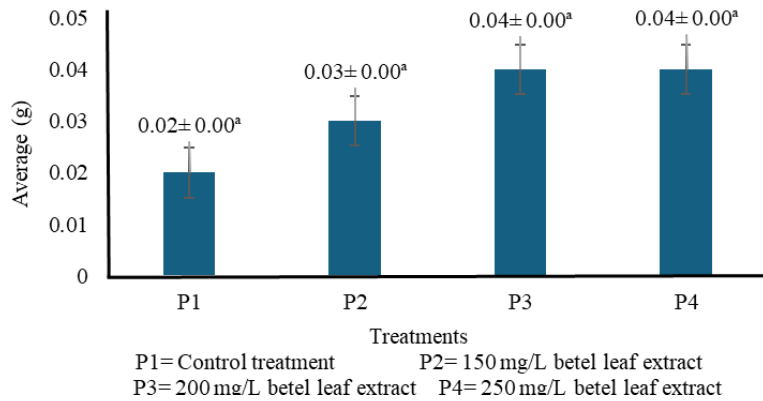


Figure 9. Absolute weight

Figure 9 shows that soaking with piper betel extract did not result in significant differences in the weight growth of juvenile gourami.

**Absolute length growth**

The analysis of variance showed no significant differences between treatment ( $P > 0,05$ ) as presented in Figure 10.

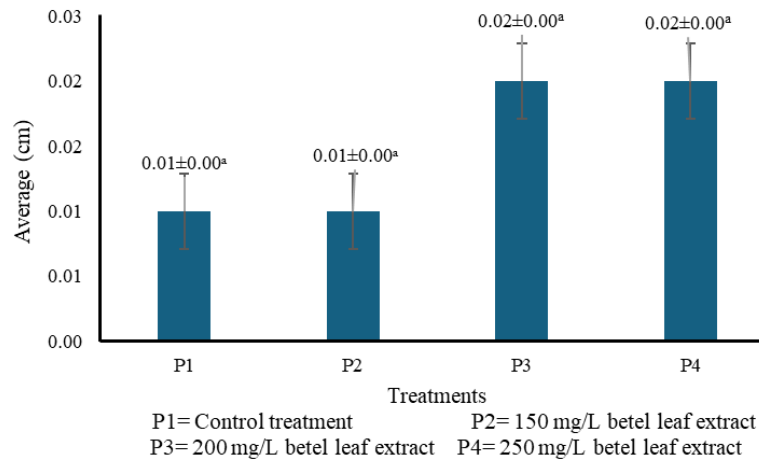


Figure 10. Absolute length

Figure 10 shows that soaking with piper betel extract had no significant effect on the absolute length growth of juvenile gourami.

**Survival Rate (SR)**

At the end of the maintenance period, the survival rate of juvenile gourami showed a significant difference ( $P < 0,05$ ) (Figure 11).

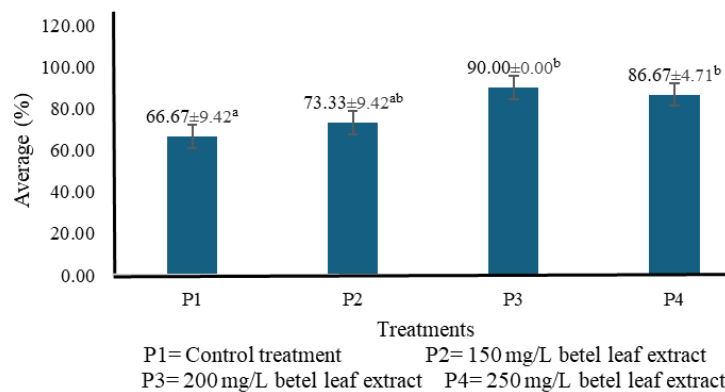


Figure 11. Survival rate

Based on Figure 11 soaking with piper betle extract showed an effect on the survival rate of the juveniles. Treatment P3 (piper betle extract at 200 mg/L) resulted in the highest survival rate, while P1 (control) showed the lowest survival rate. The Duncan test showed that treatment P1 was significantly different from treatment P3 and P4.

### Food Conversion Ratio (FCR)

Analysis of variance showed that there were no significant differences ( $P>0,05$ ) among the treatment, as shown in Figure 12.

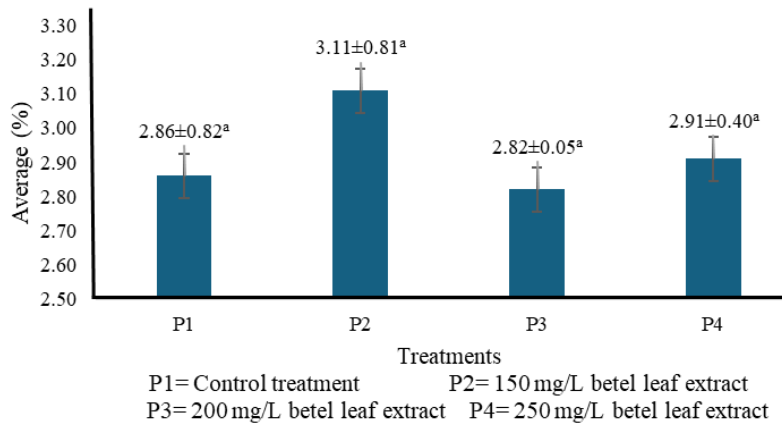


Figure 12. Food Conversion Ratio

The results in Figure 12 indicate that immersion in piper betle extract had no effect on the food conversion ratio of gourami fry.

### Water quality

Water quality is one of the key components that supports the successful rearing of gourami fry. The results of the water quality parameters measured throughout the study are presented in Table 1.

Table 1. Water Quality

Parameters	Treatments			
	P1	P2	P3	P4
pH	6.9 – 7.5	6.9 – 7.4	6.8 – 7.5	6.9 – 7.3
Temperature (°C)	24 -25.9	24 - 26	24 – 26.8	24 – 26.7
DO (mg/L)	4.1 – 7.4	4.0 – 7.3	4.0 – 7.4	4.0 – 7.4
TAN (mg/L)	0.04	0.04	0.04	0.04

Based on table 1 the recorded water quality values during the rearing period were as follows: a temperature of 25°C, an average pH of 7,2 an average dissolved oxygen level of 6,5 mg/L and an average total ammonia concentration of 0,04 mg/L.

### Discussion

The *Trichodina* sp. parasite in the fry rearing pond exhibited a high prevalence, this high prevalence is suspected to be caused by water quality that was not suitable for fish rearing. This statement is in line with the opinion of Baticados and Paclibare (1992) as cited in Afifah et al. (2014) who stated that high *Trichodina* sp. populations are influenced by the optimal binary fission rate at temperatures ranging from 20-24°C. In addition, fry with a size 2-3 cm tend to be more susceptible to parasite because at this fry stage the fish's immune system has not yet fully developed and is still weak, the results are consistent with the findings of previous research conducted by Haryono et al. (2016) that the fish's immune system is fully developed in adult fish, in contrast fish in the fry stage have lower immunity making it easier for parasites

to infect them. The results of the study prove that immersion had an effect on reducing the prevalence of *Trichodina* sp. from severe infection to mild infection, this is due to the presence of compounds in piper betle extract such as phenols. Phenolic compounds can act as antioxidants penetrating the cell wall of *Trichodina* sp. parasite leading to their death, this occurs due to the dissolution of membrane lipids and the denaturation of proteins which obstructs permeability and causes leakage of the cell's contents. as a result, the growth *Trichodina* sp. parasite is disrupted leading to their eventual death (Agustina et al. 2018).

The decrease in the prevalence of *Gyrodactylus* sp. is suspected to be due to the compounds contained in piper betle extract which can reduce the population of *Gyrodactylus* sp. in gourami fry. This suspicion is supported by the statement of Azahar et al. (2020), who mentioned that piper betle contain bioactive compounds such as chavibetol, tannins, eugenol, hydroxychavicol and flavonoids. Piper betle contents can act as antioxidants, antimicrobials, anti-inflammatories (Singh et al. 2023) and antiparasitics (Mufidah, 2021). Compounds that can be utilized as antiparasitics include tannins (Rosidah, 2022) and flavonoids (Raveter et al. 2014). Tannins can cause shrinkage of the cell membrane and reduce cell permeability, thereby inhibiting or killing the parasite cells due to the malfunctioning of the cells (Ardilla, 2022; Afifah et al. 2014). Flavonoids are natural secondary metabolites found in plants and have benefits for immune system support (Nithya et al. 2016). According to Afifah et al. (2014), flavonoids can inhibit parasite growth because they can destroy the cell membrane by damaging the protein structure leading to cell content damage that blocks growth and triggers parasite death. Water quality is one of the parameters that serves as an indicator supporting the spread of ectoparasite in fish, this statement is in line with the findings of a previous study by (2021) which suggested that good water quality can suppress the population of *Gyrodactylus* sp. as poor water quality can make fish more susceptible to ectoparasite infections.

The decrease in the prevalence of *Dactylogyrus* sp. occurred after immersion, possibly due to the essential oils in piper betle which can cause the death of ectoparasite. Essential oils contain several components such as phenolic compounds and their derivatives (Agustina et al. 2019). Phenols in piper betle can protect fry from ectoparasite attacks, as phenolic compounds can damage the ectoparasite plasma and lead to their death (Irnidayanti et al. 2021), by denaturing proteins and disrupting the protein structure leading to damage to the cell wall as the polypeptide chains are unable to maintain their original shape (Olla, 2019).

The results of the study show that increasing the concentration of the extract during immersion has the potential to reduce the intensity of *Trichodina* sp. infection. This finding supports the research of Agustina et al. (2018) which indicated that as the concentration of piper betle extract used in antiparasitic tests on fish fry increases, the reduction *Trichodina* sp. intensity becomes more significant. The decrease in intensity is suspected to be due to the response from the antioxidant content in piper betle. The compound chavicol with its strong spicy aromatic properties, can reduce the intensity of *Trichodina* sp. parasites. The aromatic produced by piper betle is due to the strong antiseptic properties of chavicol (Sengupta and Banik, 2013), which can significantly reduce ectoparasite intensity by denaturing cell proteins preventing them from performing their functions (Hermanto *et al.* 2023).

The decrease in the intensity of *Gyrodactylus* sp. parasite is suspected to be caused by the chemical components in piper betle extract such as alkaloids and tannins which can reduce parasite intensity. Alkaloids are active compounds found in piper betle that function as antiseptics helping to control parasite and infections in fish as well as boosting immunity. According to research by (Kapondo et al. 2020) alkaloid compounds can be used as antiseptics and to treat wounds caused by infections (Akhmadi et al. 2022) and they can also stimulate mucus production which enhances fish immunity (Chandra and Aji, 2023). Another compound in piper betle is tannin. Tannins are polar polyphenolic compounds (Sadiah et al. 2022) that can act as antiparasitics (Ridwan et al. 2020). Tannins can also inhibit parasite growth and

cause parasite death by shrinking the cell membrane, which obstructs cell permeability preventing the cells from performing their normal life activities (Ardilla, 2022).

The reduced infection of *Dactylogyrus* sp. parasites is suspected to be due to the piper betle extract which contains saponins that can act as antiparasitics and enhance immunity. This is supported by the research of Raveter et al. (2014) which found that saponins are immunomodulators that can restore the immune system of fish fry and help combat various pathogens. Saponins are chemical compounds that can kill parasitic worm in fish (Syukur et al. 2016), the mechanism of saponins involves forming complex compounds to block plasma membrane permeability (Afifah et al. 2014).

Immersion of fish fry using different doses did not show significant differences in weight growth, indicating that the active compounds in piper betle such as flavonoids, tannins, chavicol, phenol, and saponins are more effective as antiparasitics than in promoting the metabolism of gourami fry. Immersion had no effect on absolute weight, as the 14 day rearing period was considered too short to observe changes in absolute weight in gourami fry. This is in accordance with studies by Sulistyono et al. (2016); Setiadi et al. (2016); Dowsaniba et al. (2024) which found that weight growth in fish fry becomes evident after 30-35 day of rearing. Gourami fish grow more slowly compared to other freshwater fish species (Rohy et al. 2014).

Immersion with piper betle leaf extract did not show significant differences in absolute length growth because the 14 day rearing period was considered insufficient to observe length growth in fish fry. This is supported by the research conducted by Qitanong (2006) which found that gourami fish grow slowly and require 1,5 year for 2-3 cm fry to reach a marketable size (500 grams). This study shows that immersion had no effect on the absolute length growth of gourami fry.

Observations showed that the piper betle extract treatment at a dose of 200 mg/L resulted in higher survival rates of gourami fry compared to the other treatment, this is suspected to be the optimal dose for the survival rate of fry during the 14 day rearing period. The survival rate of fish fry in this study ranged from 73-96%, which is higher compared to the study conducted by (Bintang et al. 2024) it was found that the survival rate ranged from 40% to 80% with immersion in piper betle extract at a dose of 600 ppm. The survival rate of gourami fry is suspected to be influenced by several factor, as stated by (Arzad et al. 2019) who mentioned that factors such as feed quality, stocking density, the presence of diseases, and water conditions including temperature, nitrite, ammonia levels, pH and dissolved oxygen can affect fish survival rate. Based on the water quality data obtained after immersion oxygen and total ammonia levels were still within the standard living conditions for gourami fish. Immersion in piper betle extract can heal wound on fish and enhance their immune system, due to the secondary metabolite in piper betle that act as antiseptics, antioxidants (Hermanto et al. 2023) and immunostimulants (Nafiqoh et al. 2021). As a result infected fish can recover because the piper betle immersion boosts their immunity. The compounds in piper betle that act as antioxidants include phenolics (Hidayah et al. 2022).

The FCR results did not show significant differences between all treatments, including the control and treatments with various doses of piper betle extract. This is suspected to be due to poor feed quality and the short duration of the study. Feed with a rotten smell is one example of poor feed quality, which aligns with findings by (Arief et al. 2011) who stated that poor-quality feed such as feed that easily crumbles or has an unpleasant odor, does not stimulate fish appetite resulting in uneaten and wasted feed. Furthermore the short duration of the study made the FCR results not significantly affect the fish's metabolism. The lower the food conversion ratio the less feed is required as supported by (Ardita et al. 2015) who found that a smaller FCR value leads to more efficient feed utilization and better growth. However, if the FCR is large it indicates that feed utilization efficiency is poor.

Water quality plays a crucial role in supporting the growth and development of fish, making it a key factor in the success of fish farming. During the study, water quality was monitored to prevent mortality and ensure the health of the fish. During the maintenance period the water quality achieved was within a range that is good and suitable to support the life of the seeds. This is in line with the statement of Handaryono (2015) which mentions that the optimal temperature for gourami fish farming is in the range of 25-30°C. The ideal pH for the growth of gourami fish is between 5-7,8 (Simanjuntak et al. 2021). The dissolved oxygen levels for gourami fish range from 6,3 – 7,5 mg/L (Usman et al. 2022), while the presence of the labyrinth organ in gourami fish allows them to survive in water with low dissolved oxygen content, as low as 2 mg/L (Puspitasari, 2018). The ammonia level that can be tolerated by gourami fish is < 1,5 mg/L (Wahyuningsih and Gitarama, 2020).

### **Conclusion**

Three types of ectoparasite were found on gourami fish seeds, namely *Trichodina* sp., *Gyrodactylus* sp., and *Dactylogyrus* sp.. The best treatment for reducing the prevalence and intensity of ectoparasite was the immersion of piper betle extract at doses of 200 mg/L and 250 mg/L. The highest survival rate of gourami fish was observed in the treatment with 250 mg/L of piper betle extract, indicating that the use of piper betle extract could be a good alternative in gourami fish farming activities. However, immersion in piper betle extract did not have a significant impact on the growth in length, weight and food conversion ratio.

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