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The Effect of Giving Ketapang Leaves and Betel Leaves on the Survival Rate of Betta Fish (*Betta splendens*)

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ABSTRACT

A common problem faced by betta fish breeders during the hatchery stage is the low survival rate of fry, as they are highly susceptible to changes in water quality and disease. Therefore, fry management is necessary to increase survival rates by using natural ingredients that are environmentally friendly and do not cause resistance. Ketapang leaves (*Terminalia catappa*) and betel leaves (*Piper betle)* can be used because they contain active compounds such as flavonoids, which have antimicrobial properties that can help inhibit the growth of bacteria and fungi in the water. The aim of this study was to determine the appropriate dosage of ketapang leaves and betel leaves for the survival rate of betta fry. This study used an experimental method, namely RAL with 4 treatments and 3 replications, the treatments tested were P0 (control): no treatment, P1: 1 g/l ketapang leaves, P2: 1 g/l betel leaves, P3: 0.5 g/l ketapang leaves and 0.5 g/l betel leaves. The parameters tested included absolute weight, absolute length, specific weight growth, daily length growth and survival rate. The results showed that the average absolute weight of betta fish ranged from 0.193-0.444 g, the average absolute length ranged from 2.379-3.021 cm, the average specific growth rate ranged from 0.015-0.006%/day, the average daily growth rate ranged from 0.034-0.019%/day, and the average survival rate ranged from 60.00-13.33%.

INTRODUCTION

Indonesia offers tremendous potential in the global ornamental fish market, boasting a rich variety of 400 species of the 1,100 freshwater ornamental fish traded internationally. However, to date, only 90 species have been successfully cultivated by the community. One type of freshwater ornamental fish that remains a favorite on the global market with a high selling price is the betta fish (*Betta splendens*) (Iskandar *et al*., 2021).

Betta fish are a popular freshwater ornamental fish, both locally and internationally. They possess unique appeal, including their beautiful colors and graceful fins. There are various types of betta fish, including plakat, halfmond, crowntail, and doubletail. Furthermore,

there is a giant variety, which is much larger than the standard betta. High-quality fry will help breeders compete in the global market (Alam *et al.,* 2022).

According to Azhari *et al*. (2023), high-quality fish fry are crucial for success in the aquaculture business. One of the challenges often faced by betta fish farmers is the hatchery stage, where the low survival rate is a major cause of failure. At the hatchery stage, betta fish are highly susceptible to changes in water quality and various diseases. Betta fish hatchery techniques should utilize natural ingredients that are environmentally safe, do not cause resistance, and are free from carcinogenic properties (Afrida *et al.,* 2020).

Ketapang leaves can be used to increase the survival rate of betta fry and maintain water quality. Ketapang leaves contain active compounds, such as flavonoids, which have antimicrobial properties that function to suppress the growth of bacteria and fungi in water. Yuniar *et al*. (2023) stated that besides ketapang leaves, another natural plant that can be used to increase the survival rate of fry is betel leaves. Betel leaves contain active chemical compounds such as essential oils that can increase the immune system of betta fish. The components consist of beta-phenols, which function as antibacterial agents, steroids, tannins, flavonoids, saponins, phenols, and alkaloids, which can inhibit cell division in bacteria (Sadiah *et al*., 2022).

Research conducted by Mumpuni (2016) showed that adding a solution of ketapang leaves to the maintenance medium for tilapia fry resulted in a high survival rate, reaching 64% at a dose of 0.5 g/liter, the highest dose in the study. This suggests that there may be potential for increasing the dose to achieve better survival rates. The study aimed to analyze the effect of administering ketapang leaves and betel leaves at the same dose on the survival of betta fry (*Betta splendens*).

METHODS

Place and Time of Research

This research was conducted for 30 days starting from July to August 2025. Fish maintenance and water quality checks were carried out at the Fish Production and Reproduction Laboratory of the Aquaculture Study Program, University of Mataram.

Tools and Materials

The tools and materials used in this study include stationery, autoclave, Bunsen burner, petri dish, colony counter, DO meter, Erlenmeyer flask, cell phone, hot plate, 15 L container, refrigerator, micropipette, oven, ruler, pH meter, scoop, staining jar, thermometer, tip, tube, and vortex mixer. While the materials used include fresh water, sample water, 70% alcohol, aluminum foil, distilled water, betel leaves, ketapang leaves, betta fish, label paper, NaCl, natural food, shilk, and tissue.

Research Methods

The method used in this study was a Completely Randomized Design (CRD) where different treatments were randomly assigned to one group. This study used 3 treatments and 1 control with 3 replications each. The treatments for the use of ketapang leaves and betel leaves refers to the research of Rangkuti *et al*. (2025) where P0 (control): no treatment; P1: ketapang leaves 1 g/l; P2: betel leaves 1 g/l; P3: ketapang leaves 0.5 and betel leaves 0.5 g/l.

Preparation of Test Materials

The test materials used in this study were dried ketapang leaves and green betel leaves.

- Ketapang leaf treatment according to Saidah *et al*. (2022):
  1. Wash the dried Ketapang leaves using clean water.

2. Put the Ketapang leaves into a bucket, add fresh water, and leave for 1-2 days to remove the oil.
3. Clean the Ketapang leaves using running water until clean and dry them in the sun for 1-2 days.
4. Weigh 1 gram of ketapang leaves.
5. Ketapang leaves are placed in the maintenance container.

- Betel Leaf Treatment according to Yuniar *et al*. (2023):
  1. Wash the betel leaves using fresh water.
  2. Leave the betel leaves to dry for 30-60 minutes.
  3. Weigh 1 gram of betel leaves.
  4. Betel leaves are placed in the maintenance container.

Research Parameter

Absolute Weight Growth

According to Effendi (1997), absolute weight growth is the actual average change in size, namely the beginning of the study and the end of the study. The measurement of the absolute weight growth rate is measured using the formula:

$$AW = W_t - W_0$$

Where:
AW = Absolute weight growth (g)
Wt = Average weight at the end of research (g)
W_0 = Average weight at the beginning of research (g)

Specific Weight Growth Rate (SWGR)

The specific weight growth rate is the daily weight growth of fish determined to calculate how much weight the fish increases each day using the formula of Ihsanudin *et al*. (2014):

$$SWGR = (\ln W_t - \ln W_0) \times t^{-1} \times 100\%$$

Where:
SWGR = Specific Weight Growth Rate (%/day)
Wt = Fish biomass at the end of research (g)
W_0 = Fish biomass at the beginning of research (g)
T = Research time (days)

Absolute Length Growth

Absolute length growth is the difference between the length of the fish from the tip of the head to the tip of the tail at the end of the study and the body length at the beginning of the study. Absolute length growth is calculated using the formula from Effendi (1997):

$$L = L_t - L_0$$

Where :
L = Absolute length growth (cm)
L_t = Average length at the end of research (cm)
L_0 = Average length at the beginning of research (cm)

Specific Length Growth Rate

To calculate the daily growth rate using the formula of Sari *et al*. (2017), namely:

$$SLGR = \frac{\ln L_t - \ln L_0}{t} \times 100\%$$

Where:
SLGR = Specific Length Growth Rate (%/day)
L_t = Average length of fish at the end of research (cm)
L_0 = Average length of fish at the beginning of research (cm)

t = Research time (days)

Survival Rate (SR)

To calculate the survival rate or survival rate of fish seeds at the end of the study, survival rate was determined using the formula discovered by Effendi (1997), namely:

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

Where:

SR = Survival rate (%)

N_t = Number of surviving fish at the end of research (fish)

N_0 = Number of fish at the beginning of research (fish)

Water Quality

The water quality parameters measured in this study were dissolved oxygen, acidity (pH), and water temperature. Water quality measurements were conducted every 15 days in each maintenance tank.

Data Analysis

The data obtained from the research will be analyzed statistically using ANOVA at a 5% significance level. If the results are significantly different, further analysis will be carried out using the BNT test.

RESULTS

Absolute Weight Growth

The results of absolute weight measurements of *Betta splendens* are presented in the graph Figure 1.

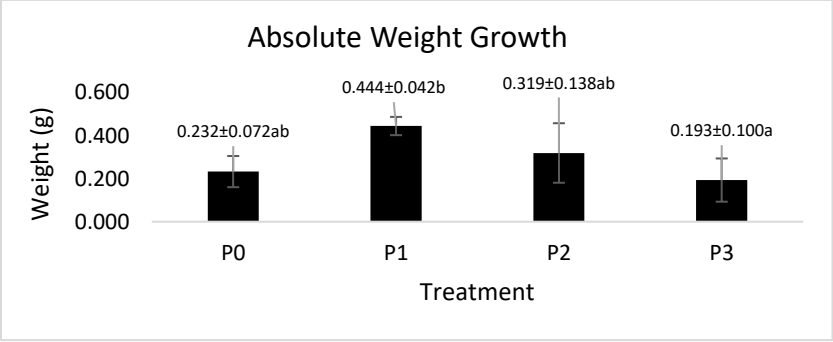

Figure 1. Absolute Weight Growth of *Betta splendens*

Specific Weight Growth Rate

The results of the specific weight growth rate of *Betta splendens* with different treatments are presented in Figure 2.

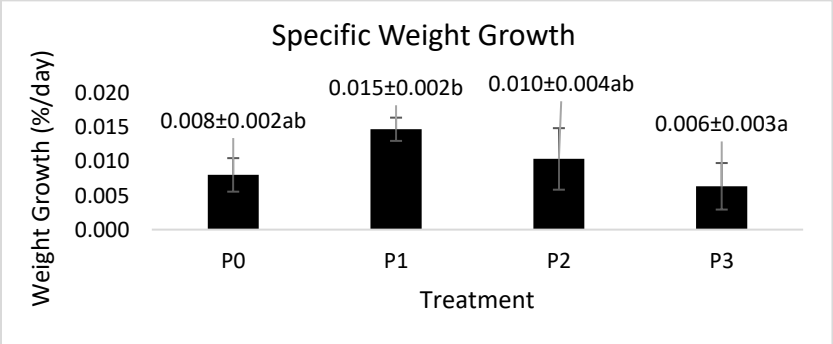

Figure 2. Specific Weight Growth Rate of *Betta splendens*

Absolute Length Growth

The results of absolute length growth of *Betta splendens* with different treatments are shown in Figure 3.

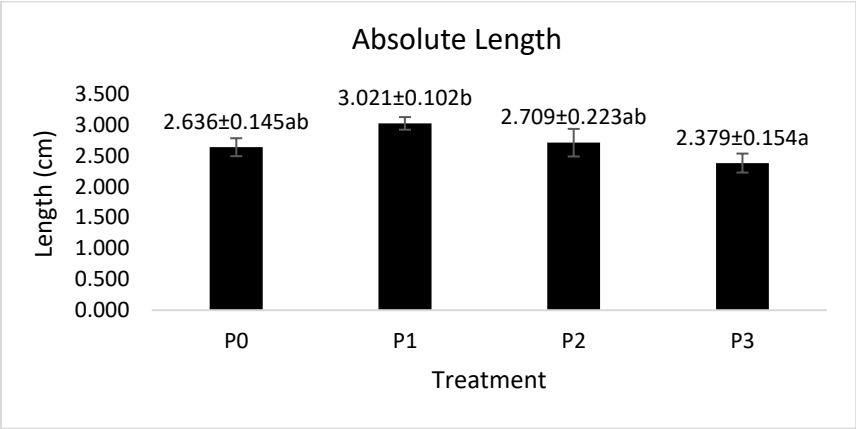

Figure 3. Absolute Length Growth of *Betta splendens*

Specific Length Growth Rate

The results of specific length growth rate of *Betta splendens* with different treatments are presented in Figure 4.

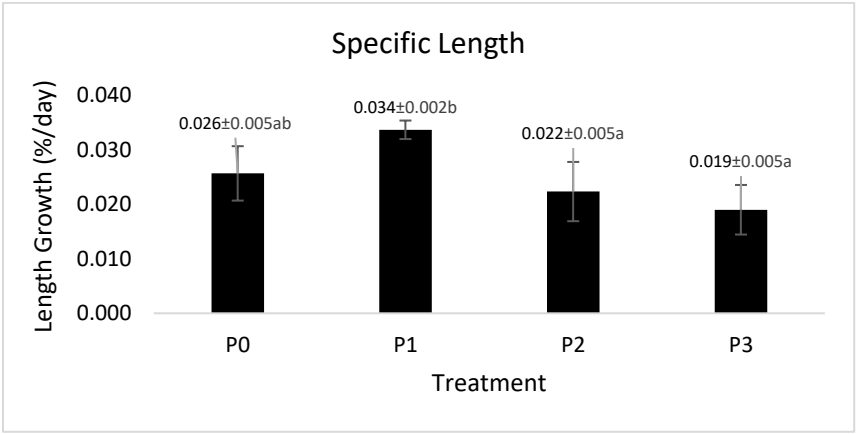

Figure 4. Specific Length Growth Rate of *Betta splendens*

Survival Rate (SR)

The survival rate (SR) results of *Betta splendens* with different treatments are presented in Figure 5.

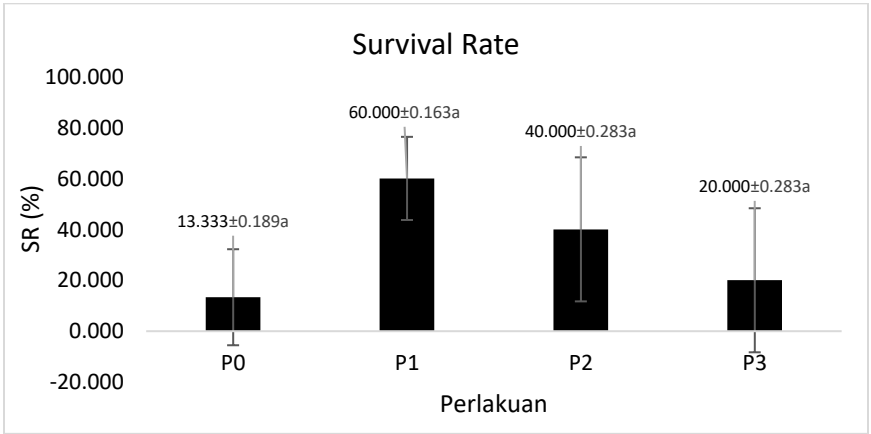

Figure 5. Survival Rate of *Betta splendens*

Water Quality

The results of water quality measurements are presented in the form of an average for all treatments on days 0, 15 and 30. Details can be seen in Table 1 below.

Tabel 1. Water Quality Measurement

Days	Temperature (°C)	pH	Dissolved Oxygen (mg L^{-1})
0	27.6	6.06	6.6
15	28.9	6.19	6.9
30	26.6	7.14	7.2

DISCUSSION

Absolute Weight Growth

Based on the analysis of the absolute weight graph, it appears that the effects of using ketapang leaves and betel leaves at the same dose showed no significant results (p>0.05%) on the absolute weight growth of betta fish. The highest absolute weight increase, in treatment P1, at 0.444 grams, may be triggered by the antibacterial properties of ketapang leaves, namely flavonoids and tannins. These substances have been proven to be able to suppress the proliferation (growth) of pathogenic bacteria in the maintenance container, thereby helping the fish stay healthy and not easily stressed, allowing the betta fish fry to make maximum use of the feed given (Adi *et al*., 2024).

Meanwhile, the low absolute weight values observed in the P3 treatment were due to the ingredients in ketapang and betel leaves when used in excessive amounts. For example, the pungent compound in betel leaves, chavicol, which imparts a spicy flavor when administered in inappropriate doses, can trigger behavioral changes and decreased appetite, ultimately inhibiting the growth of betta fry (Yuniar *et al*., 2022).

Specific Weight Growth Rate

The specific growth data showed that the use of ketapang leaves and betel leaves showed no significant impact (p>0.05%) on the specific growth of the fish. Observations made during the betta fry rearing process revealed that the highest specific growth rate was recorded in the P1 treatment at 0.015%. This is due to the creation of a healthy, comfortable, and optimal environment for the fish. A stress-free and healthy environment helps fish reach their growth potential.

In contrast, the lowest value was obtained in treatment P3, namely 0.006%/day, which was caused by the excessive content of compounds in ketapang leaves and betel leaves, such as saponins and tannins, which can create a bitter and astringent taste in the rearing medium. Therefore, the fish fry are less willing to eat the feed given, which is one of the main reasons why the specific growth rate value in betta fish fry is low (Artika *et al*., 2022).

Absolute Length Growth

Furthermore, for absolute length, it was found that the effect of using ketapang leaves and betel leaves on the growth of absolute length of betta fish fry showed significant results (p<0.05%) in increasing the absolute length of betta fish. The maximum increase in treatment P1 which reached 3.021 cm was caused by the presence of active compounds in ketapang leaves, namely tannins, which can improve water quality for fish. In addition, the antioxidant properties in ketapang leaves function to reduce stress on betta fish fry and increase the body's resistance to disease, which can support optimal growth in the length of betta fish fry (Mulyani & Asri, 2025).

On the other hand, the low absolute length value in treatment P3 was due to the administration of ketapang and betel leaves exceeding the optimal limit. This combination can increase saponin levels in the water, which can reduce fish appetite, stress them, and disrupt their growth. Furthermore, the pungent substance in betel leaves, chavicol, can impart a spicy flavor if not dosed correctly, leading to behavioral changes and loss of appetite (Yuniar *et al*., 2022).

Specific Length Growth Rate

The effect of administering ketapang leaves and betel leaves on the daily length growth of betta fish showed significant results ($p<0.05\%$) on the absolute weight of betta fish. The highest specific length growth rate was found in treatment P1, which reached 0.034 cm. This is due to the level of efficiency of feed consumption, better water conditions can affect the fish to be more effective in processing feed which ultimately supports optimal length growth of the fish (Sulmartiwi *et al*., 2025).

Meanwhile, the lowest daily growth rate was observed in treatment P3, at 0.19% per day. This is due to the combination of active compounds in ketapang and betel leaves exceeding the tolerance threshold, disrupting the fish's normal metabolic processes, which are essential for growth. Furthermore, the excessive antibacterial activity of betel and ketapang leaves can effectively kill pathogenic bacteria. However, if used too strongly and continuously, it can disrupt the balance of intestinal microflora (beneficial bacteria), which plays a crucial role in digestion and nutrient absorption (Rangkuti *et al*., 2025).

Survival Rate (SR)

Based on data analysis from the ANOVA test, the use of ketapang leaves and betel leaves produced an insignificant effect ($p>0.05\%$) on the survival rate of betta fish (SR). The highest survival rate was found in treatment P1 with a percentage of 60.00%. As stated by Purba et al. (2023), the optimal survival rate for betta fish is considered to be above 60%. This high value is due to the antibacterial properties of ketapang leaves, thanks to compounds such as flavonoids and tannins that can inhibit the growth of pathogenic bacteria in the rearing environment. This is consistent with the findings of Mulyani & Asri (2025), who found that ketapang leaf extract plays a significant role in reducing bacterial counts in catfish cultivation systems.

The low survival rate of 13.33% in the P0 treatment was due to the absence of antibacterial compounds that can prevent bacterial growth in the water, resulting in a decline in the immune system of the betta fry. This decline makes the fish more susceptible to disease, stress, and infection from microorganisms such as bacteria, viruses, and parasites. This condition can cause death in fish, in accordance with the opinion of Suhendar *et al*. (2020), who stated that rearing media that does not contain antibacterials can make fish more susceptible to bacterial infections and reduce the immune system, which can potentially lead to death in fish.

Water Quality

Temperature is a crucial factor that can influence fish production and metabolism. The optimal temperature range is between 26.6 and 28.9°C. This temperature is considered favorable for the survival of betta fry during rearing. According to Saputra *et al*. (2022), the optimal temperature for betta fish is between 27 and 32°C.

In this study, the pH measurements ranged from 6.06 to 7.14. This pH range is considered good and optimal for the survival of betta fry. Fish can grow and develop well in favorable aquatic conditions. According to Bukhori (2018), the appropriate pH for betta fry is between 6 and 8.

Meanwhile, the dissolved oxygen values obtained in this study were 6.6–7.2 mg/l. These dissolved oxygen values are considered good for the survival of betta fry. According to Saputra et al. (2022), a good DO value for betta fish cultivation ranges from 5 mg/l to 8 mg/l.

CONCLUSION

The conclusion obtained in this study is that the administration of ketapang leaves and betel leaves with the same dose on the survival rate of betta fish fry gives results that do not have a real (significant) effect on absolute weight, absolute length, specific weight growth rate, specific length growth rate and survival rate of betta fish fry. Soaking ketapang and betel leaves for too long can make the water toxic and increase fish stress. This defeats the primary goal of using ketapang and betel leaves to improve survival.

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