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Extract of Leaves (*Terminalia catappa* L.) to Improve Survival and Growth of Black Ghost *Apteronotus albifrons*

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Abstract

This research aimed to determine the effect of Terminalia catappa extract on water quality, growth, and survival of black ghost fish (Apteronotus albifrons) juveniles. The container used is an aquarium measuring 30 x 20 x 21 cm with a water volume of 10 liters each. The test fish used came from farmers in Bogor. Fish were stocked at a stocking density of 4 fish/L with an average fish size of 2.89 cm. The maintenance medium was added with dry T. catappa leaves in different amounts as well as treatments, namely treatment 1 as control, treatment 2 with a dose of 1 g/L, treatment 3 with 2 g/L, and treatment 4 with a dose of 3 g/L each repeated 4 times. The type of feed used is tubifex worms with 2 administration times in the morning and evening ad libitum. The parameters observed were survival, growth (weight and length), and water quality. The results of the research show that the best medium for rearing black ghost fish seeds is the addition of 1 g/liter T catappa leaves. The highest survival was 31.25% while the lowest survival was in the control at 5%, the absolute length growth was 1.54 cm and the growth rate (weight) was 0.43 g. Survival is influenced by the hardness of the research media with a fairly large range of seed survival, the active substance given through T .catappa leaf extract can increase the growth and survival of *Apteronotus albifrons.*

***Keywords**:* Apteronotus albifrons**,** T.catappa, Extract**,** Survival Rate, growth, and water quality

1. Introduction

Ornamental fish is one of the fishery commodities that has recently become a potential trade commodity to be developed both at home and abroad. Ornamental fish have a diversity of species, namely marine and freshwater ornamental fish, several species can be cultivated, both native to Indonesia and introduced fish. Of the many freshwater ornamental fish that have good market opportunities, the Black ghost fish comes from the Amazon River, in South America. The Black Ghost fish *Apteronotus albifront* is a freshwater ornamental fish commodity that can be cultivated in Indonesia and is a species that can be exported to several countries. This fish has an attraction with its shape and color and movement when in the aquarium adds to the beauty and elegance of this fish so it is liked by many hobbyists. With the main characteristics of blue to dark purple to blackish and sometimes looks pitch black, the body shape is flat, the pectoral and pelvic fins are fused to the base of the tail, and on the head there is a white stripe to the back, on the tail there is also a white stripe to the back, and the ring-shaped white. This fish has the nickname ghost fish or devil fish. This nickname is not quite right because the appearance of this ornamental fish has the physical characteristic of having several scratches or white lines from the head to the mouth. Ornamental fish are one of the potential fisheries commodities in Bogor City, with no less than 200 Cultivating Households spread across six sub-districts in Bogor City (Supena, 2010). The potential for commercial ornamental fish is quite popular in big cities such as Jakarta, Depok, Surabaya, Semarang, Sukabumi, and Bogor (Rozi et al, 2017). This shows that Black Ghost has opportunities and prospects to be developed as an economic opportunity for the people who cultivate it. Black ghost cultivation businesses can be grouped into seeding and nursery businesses, seeding is carried out by caring for broodstock to produce seeds of a certain size according to the needs of the results of the spawning process, while nursery is a follow-up activity in maintaining seeds after seeding to produce seeds that are ready to be sown in the unit. production of enlargement or seeds that are ready to sell (Effendi, 2004). Management of ornamental fish cultivation often does not implement the SOPs that have been determined by the farmers. Farmers often do not implement them because there are additional activities that interfere with routine activities that can be carried out. The case study occurred in Sri Lanka with the most disease being

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white spots at 36.9% and cultivators only carried out prevention by changing the water at 81.2% (Karhala et al, 2022).

In reality, in cultivating black ghost fish there are still many obstacles that have an impact on decreasing production results. The problem of unsupportive water quality is often encountered in cultivating black ghost fish. Hadinata (2013), found sources of production risk for black ghost fish, namely changes in water quality, disease, and fish attacking each other. The critical period occurs when transferring or rearing fish that are 3-4 weeks after hatching, where the survival rate obtained is very wide so that the risk of death is very high, especially with changes or differences in water quality, especially the acidity and hardness of the cultivation media. Hardness, also known as hardness, is a parameter of low groundwater quality, which is caused by rock structure and soil type. Hardness consists of two types, namely non-carbonate hardness caused by calcium and magnesium ions associated with SO^{42+}, Cl, and NO_3- ions; and carbonate hardness caused by calcium and magnesium ions associated with CO_3^{2-} and HCO_3^{3-} ions 3). (Rahmawati et al., 2018).

Water quality influences the life and growth of fish, this is to Hepher and Pruginin (1981), fish growth depends on several factors; namely the type of fish, genetic characteristics, ability to utilize food, resistance to disease, and environmental factors such as water quality, space, and density. Many studies have been carried out to overcome the problems of water quality. The use of natural ingredients from *T catappa* which contain active ingredients in the form of antioxidants that can prevent or inhibit the development of fungi and bacteria and improve the hardness of the rearing media can be used as an alternative to prevent these fish from getting disease and reduce fish mortality. The extract is also able to reduce the development of fungus during fish rearing (Muray et al, 2023). For water quality, *T catappa* leaf extract can reduce water hardness by 37.5% (Rahmawati et al., 2018). Dosing 400 mg/l $CaCO_3$ provided significantly lower levels of ammonia-N excretion or oxygen consumption, indicating greater energy expenditure of *M. salmoides* at lower water hardness. These results indicate that although high water hardness substantially increases stress resistance, they do not require high water hardness for optimal growth (Romano et al, 2020). So far, black ghost fish cultivators who use *T. catappa* leaves as a disease-prevention agent have not applied the correct dosage. Research into the need for optimal extract of *T catappa* leaves to maintain water quality and increase the survival and growth of Black Ghost seeds needs to be carried out in this research.

2. Material and Methods

2.1. Time and Place of Research

This research was conducted for 30 months in April-May 2021 at the Ornamental Fish Cultivation Research Center, Depok.

2.2. Diet Preparation

The tools used in this research are 16 aquariums measuring 30 x 20 x 21cm which are equipped with aeration in each aquarium, tools in the form of a set scoop which is used as a tool to move or pick up fish, a hose to siphon or clean up leftover food. from fish waste and substrate from rope as a medium for hiding. Apart from that, for measurements, rulers and scales are used.

The material that will be used in this research is dried *T catappa* leaves, a natural food for silk worms (Tubifex sp). The test animals used for Black ghost fish seeds (*Afteronotus albifrons*) came from farmers in Bogor. In determining the number of extract of *T catappa* leaves for the treatment in this study, preliminary research was carried out by adding the largest dose, namely 3 grams/liter with a density of 4 individuals/liter. Observations were carried out for 2 x 12 hours to know the behavior of black ghost fish towards increasing the number of extract of *T catappa* leaves. Ashry (2007), stated that an excess of *T catappa* leaves in the rearing media causes fish to experience stress. If the dose of it causes the fish to experience stress or even death, then reduce the dose of *T catappa* leaves. If the dose of *T catappa* leaves does not affect the behavior and physiology of the fish, the research will continue. During maintenance, Tubifex sp feed is given ad libhithum.

2.3. Making T catappa L. Solution

The *T catappa* leaves used are T catappa leaves that have fallen from the tree and are dry and dark brown in color. Choose the ones that are good and have no defects, then wash them and dry them. Next, soak the *T catappa* L. in water for 30 minutes, drain the *T catappa* leaves, then continue soaking in fish salt water or table salt for 24 hours. One teaspoon is enough for one bucket. The purpose of settling with salt is to remove the oil and gum contained in it. After soaking for 24 hours, drain again, then dry in the sun for 2-3 days, according to weather conditions. Make sure the *T catappa* leaves are completely dry, dry T catappa leaves can be stored in a place that is not damp and can be used by placing several T catappa leaves in a dissolving container. During dissolution, the color of the water will become light brown and become darker. Soak for 1-2 days until the water changes color to yellow. The results of the *T catappa* soaking were put into an experimental container (Suwika T, 2022).

2.4. Data Analysis

This study used a completely randomized design (CRD) in one factor with four treatments and four replications. So the number of experimental units is 16 container units, and maintenance is carried out in a controlled room. The treatments tried used different soaking extract of *T catappa* leaves with the treatment; control dose 0 gram/L, dose 1 gram/L, dose 2 gram/L, and treatment dose 3 gram/L.

During this research, observations were made of; The fish seeds observed were; survival rate (SR), absolute length growth, and daily weight growth rate. The water quality observed is; temperature, dissolved oxygen, pH, alkalinity, hardness, ammonia, and nitrite.

Data were analyzed through analysis of variance (ANOVA) with the F test to determine whether the treatment had a real effect or not. If it has a real effect, a further test is carried out using the Least Significant Difference (BNT) test.

3. Results and Discussion

3.1. Water Quality During Research

The results of water quality observations given different extract of *T. catappa* for rearing Black Ghostfish, obtained the measurement results for each parameter as follows; the temperature was obtained in the range of 26.3-27.6oC, pH value ranged from 5.0-7.0, dissolved oxygen value 4.05-7.93 mg/liter, ammonia value ranged from 0.0180-0.209 mg/L, nitrite ranged from 0.021 to 1.571 mg/L, alkalinity values ranged from 10.55 to 84.88 and hardness values for controls ranged from 25.68 to 74.19. Complete water quality measurements during the research are presented in Table 1.

Table 1. Range of water quality measurements for 30 days observation

Parameter	Treatment				Parameter Standards
	Control	1 gr/L	2 gr/L	3 gr/L	
Suhu (ºC)	26,3-27,6	26,3-27,6	26,5-27,5	26,5-27,6	23-28ºC (Riehl, 1991)
Ph	5,5-7,0	5,0-7,0	5,0-6,5	5,0-6,0	6-8 (Riehl, 1991)
DO (mg/L)	5,16-7,82	4,05-7,93	4,10-7,26	4,35-7,50	>5 mg/L (Effendi, 2003)
Amonia (mg/L)	0,038-0,053	0,018-0,035	0,020-0,033	0,031-0,209	<0,02 mg/L (Effendi, 2003)
Nitrit (mg/L)	0,021-1,135	0,022-1,538	0,031-1,571	0,076-1,352	0,5-5 (Boyd, 1982)
Alkalinitas (mg/L)	21,10-74,27	10,55-84,88	21,10-84,88	31,65-53,05	30-500 (Boyd, 1982)
Kesadahan (mg/L)	25,68-74,19	5,71-62,78	7,13-65,63	8,56-64,21	5-19 (Riehl, 1991)

Data Source: Laboratory analysis data during Black Gosh (*Afternotus albifrons*) research

3.2. Survival Rate

The results of observations on survival showed that the highest value was obtained in the 1 gr/L treatment of 61.25 ± 4.33%, followed by the 2 gr/L treatment with a survival rate of 29.38 ± 4.26%, the 3 gr/L survival rate treatment. 29.38 ± 6.25% and the lowest in the control/0 gr/L survival rate was 05 ± 2.88%. The results of the ANOVA test, the control survival rate with the extract given showed a significant difference between the extract given ($p<0.05$). Complete survival rate values can be presented in Figure 1.

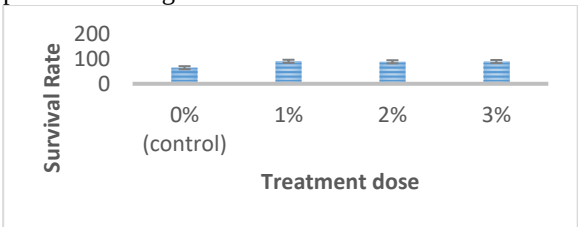

Figure 1. Survival Rate Results during Black ghost (*Afteronotus albifrons*) research.

3.3. Absolute Length Growth

The addition of different extract of *T catappa* leaf extract gave absolute growth results with the highest results obtained in the 3 gr/L treatment with an absolute length increase of 2.11 ± 0.35 cm, followed by the 0 gr/L control with 1.71 ± 0.08 cm. then the 2 gr/L treatment was 1.59 ± 0.16 cm and the lowest in the 1 gr/L treatment was 1.50 ± 0.30 cm. Absolute length growth did not show a significant difference between the extract given ($p>0.05$). Complete weight growth values can be presented in Figure 3.

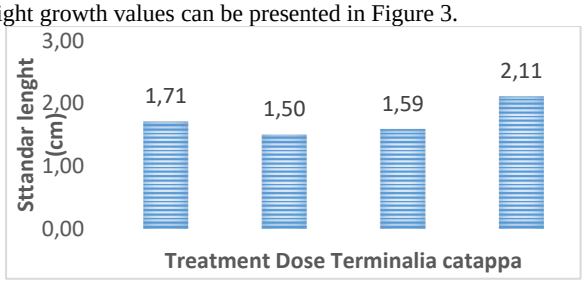

Figure 2. Absolute Length Growth of Black ghost (*Afteronotus albifrons*) research.

3.4. Weight Growth Rate

The results of measurements of the weight growth rate showed that the highest value was obtained in the 3 gram/L treatment with a weight of 2.11 ± 0.14 grams, followed by the 0 gram/L control treatment with a weight of 1.53 ± 0.07 grams, treatment 2 (1 gr/liter) with a weight of 0.43 ± 0.05 gr and the lowest in treatment 1 (control) with a weight of 0.41 ± 0.08 gr. Weight growth did not show a significant difference between the extract given ($p>0.05$). Complete weight growth values can be presented in Figure 3.

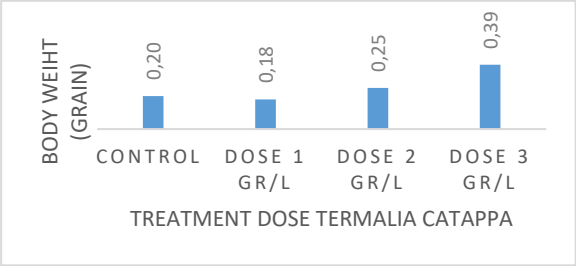

Figure 3. Black ghost (*Afteronotus albifrons*) Weight Growth Rate.

4. Discussion

Research is carried out to provide information or discoveries that are interesting and useful for scientific development and fisheries in particular. Water quality management includes aeration, water changes, siphoning, and filtering, which are ways to maintain optimal water quality. One way can also be done by using natural ingredients that have active ingredients that can maintain good water quality. The *T catappa* plant L. is a plant that contains chemical/active compounds, especially in the leaves, bark and stems, such as flavonoids, tannins, phenols, diterpenes, and fatty acids (Lin et al., 2000; Ahmed et al., 2005; Jaziroh, 2008; Saroja et al., 2011), tannin compounds (Eddy et al, 2009), flavonoids (Lin et al., 2000), triterpenoids (Gao et al., 2004), alkaloids (Mandasari, 2006), steroids (Babayi et al., 2004) and fatty acids (Jaziroh, 2008). The content of tannin compounds in *T catappa* leaves is quite high at 10.57 mg/g (Annegowda et al., 2010).

During maintenance, water quality experiences an uncontrolled decline and exceeds the threshold limit, which will harm the fish being kept, especially the size of larvae and young fry. The results of water quality observations during the research showed changes in water quality (Table. 1) in the form of acidity of the cultivation media in the pH range of 5.0-7.0, this value is still good for comfortably rearing Black Gosh fish, as stated by Riehl and Beansch (1991), the range A good pH value for black ghost fish is 6-8. The addition of *T catappa* leaf extract can improve water quality, the ion exchange method using natural filter media in the form of *T catappa* leaves can reduce the hardness of drinking water by 37.85% (Rahmawati et al 2018). Increasing hardness functions to maintain the stability of pH values so as not to disturb the balance (homeostasis) in water. The fluctuating nature of pH can be controlled with buffers, one of which is through the liming method. Liming will increase the concentration of hardness and/or alkalinity as a pH buffer in water (Boyd, 1982). The results of hardness measurements obtained figures ranging from 5.71-74.19 mg/L $CaCO_3$, this range is outside the tolerance limit of black ghost fish. The rearing media provides physiological effects for fish during the metabolic process, where the formation of energy comes from the nutrients consumed and spread throughout the body requires supporting conditions. Giving a dose of 150 mg/l $CaCO_3$ provided the best growth and maintenance of *Labeo rohita* seeds with length growth of 130.33%) and survival of 95.33% (Rajkumar et al., 2018). The addition of a dose of 72 mg/L $CaCO_3$ in the maintenance medium provided the best growth rate but had no effect on the survival rate of *Barbus conhonius* during maintenance. (Nirmala et al, 2005).

Decreased water quality in the field causes disruption to life and growth, even in acute conditions it can kill fish. This is supported by the statement by Riehl and Beansch (1991), that the hardness value of good black ghost fish is between 5-19. Water hardness or hardness is the content of certain minerals in the water, generally calcium (Ca) and magnesium (Mg) ions in the form of carbonate salts for a hardness tolerance value for biota of 1.5% and 0.6%, if it exceeds the maximum concentration. causes disruption of the metabolic system of the biota being maintained (Weiss, 2008). Hardness cannot be separated from the alkalinity value, the results of alkalinity measurements during the maintenance period range from 10.55-84.88 mg/L. Waters with an alkalinity value > 20 mg/L have a relatively high buffer capacity so that these waters are relatively stable against changes in acids and bases (Boyd, 1990), the optimal alkalinity value in a body of water is 90-150 ppm. According to Boyd (1982), a good alkalinity value ranges from 30-500 mg/l. Based on the results of measuring the alkalinity values available in the rearing media, it had a fairly large effect where fish survival was very high and was controlled at 95%.

The dissolved oxygen concentration during the maintenance period ranges from 4.05-7.93, dissolved oxygen levels in the range of 4 mg/liter or less than 5 mg/liter for certain species will reduce appetite, resulting in slow growth. According to Effendi (2003), the optimum value range for dissolved oxygen for fish growth is above 5 ppm. According to Boyd (1998), the solubility of oxygen in fresh waters is determined by temperature and altitude (the height of the location above sea level. The solubility of oxygen in water. The relationship between temperature and DO is clearly visible from the DO concentration which on average increases when the temperature decreases and vice versa when it decreases). if the temperature rises. In accordance with research, the relationship between temperature and DO is clearly visible from the DO concentration which increases by an average of 7.9 mg/l when the temperature decreases to 27.5ºC, whereas when the temperature rises to 30.3º C, the DO concentration decreased to 5.8 mg/l (Sumoharjo & Sulistyawati, 2020). Water temperatures during maintenance ranged from 26.3-27.6ºC, this temperature range is still within the tolerance limits of black ghost fish stated by Riehl (1991), namely ranging between 22-28^{0}C.

The value of ammonia levels during the maintenance period ranges from 0.018-0.209. The

range of ammonia levels that are good for fish life is below 0.02 mg/liter, in accordance with Effendi (2003), waters are toxic to fish if the ammonia levels are more than 0.02 mg/liter. The high ammonia content is also responsible for the low survival during cultivation. Nitrite is a transitional process of breaking down ammonia into nitrate. Nitrite (NO_2) values during the maintenance period ranged from 0.021-1.571. The range of nitrite values is still within the tolerance limits of black ghost fish. According to Boyd (1982), the range of nitrite levels is 0.5-5 mg/liter.

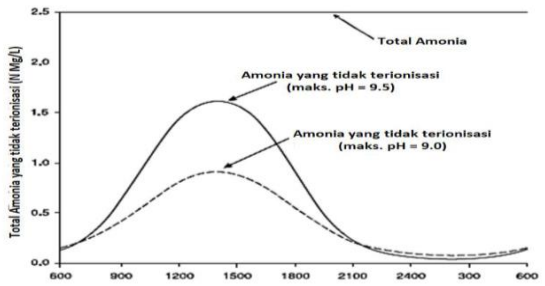

Figure 4. Effect of Daily Fluctuations in pH on Ammonia Concentration Non-Ionized (NH_3) in Fish Ponds (Hargreaves & Tucker, 2004)

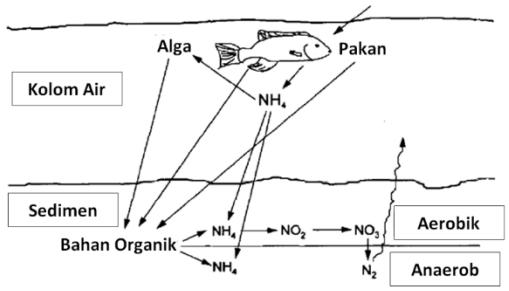

Figure 5. Nitrogen Transformation in Cultivation Systems (Rijn, 1996)

Flavanoids are the active ingredients contained in *T catappa*, these ingredients are found in many leaves and skin. Apart from these plants, flavonoids are also contained in several other plants which are preferred by monkeys and their relatives as food, Dacryodes rugosa extract has high toxicity which is applied to Artemia salina giving an LC_{50} value of 25.57 ppm with a mortality rate of 87%. (Atmoko and Ma'ruf, 2015). The results of measuring the total flavonoid content with the antioxidant activity value of the methanol extract were 460.37 mg AEAC (Ascorbic Acid Equivalent Antioxidant Capacity)/g and the isolate obtained was 19.62 mg AEAC/g (Salimi et al, 2022). The research results show that the higher the concentration of flavonoids given, the stronger the antioxidant activity. According to Majewska et al (2011), the higher the percentage of flavonoids in an ingredient, the stronger its antioxidant activity (Islami, 2017).

Based on the results of observations and diversity analysis, it showed that the optimal dose of *T catappa* leaves for survival and growth (length and weight) was obtained in treatment 2 with a dose of 1 g/liter, with the survival of 91.25%, absolute length increase of 1.54 cm and weight of 0.43 gr. Naturally, every organism can adapt to environmental changes within certain limits or what is called a tolerance level (Hoar, 1975). According to Nikolsky (1963), fish deaths can be caused by aging, abiotic conditions, predators, parasites, lack of food, and fishing. For intensive maintenance by utilizing space and maximizing adequate water quality, it provides a limit (Finding capacity) for the fish kept in the system. Optimal water quality is one of the limiting factors that must be provided properly so that fish can live, ensuring that growth and survival rates are high. At high stocking densities, space for movement becomes narrower, and competition in finding food increases so that small and less strong fish cannot survive and the need for oxygen in rearing containers increases along with increasing stocking densities. Deaths that occur in the life of fish can be reduced by providing good nutrition, balanced with antioxidants that can reduce toxins. According to Chyau, et al. (2002), antioxidants such as flavonoids, glycosides, and polyphenols are also able to prevent the narrowing of the blood vessels. Fish that are exposed to excess toxic substances can disrupt their metabolism. The *T catappa* leaf extract used in the research contains active ingredients: saponins, flavonoids, and tannins. The antioxidant content of *T catappa* leaves is different for the green, yellow, and reddish ones, the yellow and red leaves have the highest antioxidant content of 6.34-10% (Kuete et al. 2010). Based on research results, the use of red and fallen produces leaf extract which has a higher active ingredient content. Based on the results of preliminary research observations in determining the number of extract for treatment, it shows that the number of extract of 3 g/liter with a density of 4 fish/liter affects the behavior and physiology of black ghost fish. In line with research results, LC50 of *T. catappa extract* of 0.41 g/L caused changes in water quality parameters such as pH and conductivity, as well as changes in movement in juvenile *Colossoma macropomum* fish (Meneses et al, 2020). Research can be continued using the largest dose, namely 3 g/liter. Apart from being applied in rearing media, other research shows that giving *Termalia arjuna* skin powder as much as 1 g/kg of feed provides initial protection for rearing Labeo Rohita sp fish with demonstrated immunostimulant value with increased Myxovirus resistance (Meena et al. 2023).

Based on the results of observations of the weight growth rate (Figure 3), it shows that the highest value for the weight growth rate of black ghost fish was obtained in treatment 4 (2 gr/liter), namely 0.55 gr, followed by treatment 3 (2 gr/liter), namely 0.53 gr, treatment 2 (1 gr/liter) was 0.43 gr and the lowest value was in treatment 1 (control) which was 0.41 gr. Visually, increasing the dose of *T catappa* leaves

shows a difference in color density. The higher the dose of *T catappa* leaves added to the maintenance medium, the more intense the color shown on the maintenance medium. The difference in color density shown in the rearing media and the presence of active substances in the water soaking the *T catappa* leaves do not interfere with the black ghost fish's appetite. This can be seen from the results of the diversity analysis. The research results of adding *T. catappa* to *Paracheirodon axelrodi* at a dose of 1.5 gram/L provided the best growth and survival of 100%, length growth of 1.28 cm/head, and weight growth of 0.092 g/head (Nurhidayat et al, 2016). Providing food with nutrients according to needs provides positive growth for the fish being kept, according to research by Rozi et al 2017, giving Tubifex feed provides the best response with final survival of 74%. The results of the diversity analysis showed that treatment 1 (control), 2 (1 gr/liter), 3 (2 gr/liter), and treatment 4 (3 gr/liter) were not significantly different (P>0.05) (Appendix 1). Thus, the application of a dose of *T catappa* leaves did not have a significant effect on the growth rate of black ghost fish seed weight.

Based on the results of observations of absolute length increase (Figure 4), it shows that the highest absolute length increase value was obtained in treatment 4 (3 gr/liter), namely 1.91 cm, followed by treatment 3 (2 gr/liter), namely 1.7 cm, then treatment 2. (1g/liter) which was 1.54 cm and the lowest was in treatment 1 (control) which was 1.42 cm. Likewise, with the rate of weight growth, differences in the color density of the rearing media and the presence of active substances from the water soaking in *T catappa* leaves do not affect the appetite of black ghost fish, so the resulting growth (length and weight) is not significantly different as seen from the results of the analysis of variance. The results of the diversity analysis showed that the 0 gram/L (control), 1 gr/L, 2 gr/L, and 3 gr/L treatments did not provide significant differences (P>0.05). Statistically, the results of the analysis stated that giving a dose of *T catappa* leaves had no significant effect on the increase in the absolute length of black ghost fish seeds.

Based on the results of observations, the percentage of survival rates during the study (Figure 1) shows that the highest value for live fish treated with a dose of 1 gram/L was 91.25%, followed by treatment with extract of 2 and 3 grams/L with survival of 89.38 and 90.00 and the lowest was in the treatment dose of 0 gram/L (control) with a survival rate of 65%. The results of the diversity analysis showed that the survival rate of black ghost fish with the treatment dose of 0%/L (control) was significantly different (p<0.05) with treatment of 1 gram/L), 2 gr/L, and gram/L, while the extract of 1, 2 and 3 gram/L were not significantly different (P>0.05) (Appendix 1). The low survival rate in the controls was due to the lack of supply of active substances from the water soaking in the *T catappa* leaves which affected the life of the fish, so that the fish were very easily attacked by fungi or bacteria. This is by Kadarini (2010), who stated that the low survival was due to there being no supply of antibiotics from *T catappa* leaves so the fish were very easily attacked by fungi. Soaking above 375 ppm *T catappa* leaf extract contains several beneficial phytochemicals such as tannins, flavonoids, and saponins in Betta fish sp. The tannin content contained in it can reduce the pH of the water following the opinion of Miksen and Media, (2016). Adding a dose of T catappa leaves to the rearing medium showed differences in color density, the higher the dose of *T catappa* leaves added to the rearing media could disrupt the behavior of the fish. Research by Mecha and Plasus, (2023), states that as many as 7.7-38.5% of ornamental fish are attacked by disease during adaptation after transportation and then will be attacked again during maintenance if water quality decreases and body resistance also decreases. White-spot disease or ich is the most prominent disease often caused by Black Gosh fish, followed by tail and fin rot which usually attacks ornamental fish Carassius auratus), fighting Betta (*Betta splendens*) and Guppy (*Poecilla reticulata*. Prohibition of the use of OTC antibiotics (Ocxy tetra cyclin) It is very appropriate to do this because this ingredient causes the fish's immune system to decrease so that the fish are easily attacked by Aeromonas and Pseudomonas spp (Yeung et al. 2022). Hadinata (2013), found that the source of death in black ghost fish is water quality, disease, and fish. attack each other. During maintenance, several signs of stressed fish can be seen from the behavior and physiology of fish, namely dying simultaneously, moving faster than usual, often on the surface, losing balance, being passive, and the body secreting mucus.

This is caused by the fish not being suitable for the quality of the rearing water. Another thing was found the fish attacked each other, causing the fish to experience deformities in several parts of their bodies. Defects on its body can be found in the fins which look like they are torn. As a result, the fish become weak and susceptible to disease, leading to death. Thus, giving *T catappa* leaves during maintenance had a significant effect (P<0.05) on the survival of black ghost fish seeds. However, it was not significantly different (P>0.05) in the 1 gr/L treatment, 2 gr/L treatment and 3 gr/L treatment.

5. Conclusion

Based on the results of observations, the percentage of survival rates during the study (Figure 1) shows that the highest value for live fish treated with a dose of 1 gram/L was 91.25%, followed by treatment with extract of 2 and 3 grams/L with survival of 89.38 and 90.00 and the lowest was in the treatment dose of 0 gram/L (control) with a survival rate of 65%. The results of the diversity analysis showed that the survival rate of black ghost fish with the treatment dose of 0%/L (control) was significantly

different ($p<0.05$) with treatment of 1 gram/L), 2 gr/L, and gram/L, while the extract of 1, 2 and 3 gram/L were not significantly different ($P>0.05$)

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