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Effect of Adding Moringa Leaf Extract (*Moringa oliefera*) and Kencur (*Kaempferia galanga*) in Feed on Improving The Growth Performance of Catfish (*Clarias Sp*.)

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ABSTRACT

The purpose of this study is to determine the influence and determine the optimal dose of moringa leaf extract and kencur in feed on the growth performance of catfish seeds. This research was carried out at the Aquaculture Laboratory, Faculty of Fisheries and Marine Sciences Padjadjaran University from February to March 2024. Sampling in this study used an experimental method using a Complete Random Design (RAL), the growth data obtained was analyzed using the analysis of the F test variety fingerprint (ANOVA / Analysis of Varience) and for the water quality data was analyzed descriptively. The results of this study, namely the addition of 150 mg/kg of moringa leaf extract and 250 mg/kg of kencur extract to feed had an effect on improving the growth performance of catfish seeds which was more optimal than other treatments, as shown by an increase in the percentage of absolute length growth (4.2 cm), absolute weight (57.58 g), SGR (3.80%), FCR (1.44%), EPP (68.90%), and SR (100%). The water quality values during fish rearing are in the optimal range including temperature (27.5-28.3°C), pH (7.0-7.5), and DO (5.2-7.5 mg/L).

INTRODUCTION

Catfish is one of the leading fishery commodities that is being developed with high economic value and is easy to cultivate by the people of Indonesia. The demand for catfish is increasing from year to year. The high market demand for catfish requires an increase in production. Based on data obtained from the Ministry of Marine Affairs and Fisheries (2022), in 2022 the production of catfish cultivation was 1.335 million tons, higher than in 2021 of 1.06 million tons. In an effort to increase catfish production, several obstacles are still found such as stunted growth, decreased immunity so that fish are more susceptible to diseases and even death. One of the ways to overcome these problems is by providing enough nutritious feed equipped with immunostimulants. Natural ingredients that

can be used as immunostimulants are plants that contain bioactive compounds such as alkaloids, flavanoids, terpenoid phenols and steroids (Hai 2015). Moringa and kencur are plants that contain immunostimulants.

Moringa and kencur leaves can be added to the use as a substitute for the use of antibiotics (herbs) in the form of extracts that trigger fish growth and immunity. Its addition to feed is able to increase the absorption of feed optimally because kencur contains several compounds, including essential oils, turmeron, protein, carbohydrates, fats, vitamin C, iron, phosphorus, magnesium, alkaloids, flavonoids, tannins, and saponins (Gupta *et al*. 2015). Meanwhile, moringa leaves contain flavonoids, tannins, saponins, alkaloids, and terpenoids that have been proven to be able to increase the immune system in fish (Mbokane and Moyo 2019). In the research of Kurniawan *et al*. (2020) for catfish, the addition of kencur herbal supplements in feed can increase growth performance.

Based on the potential of moringa leaf extracts and kencur above, research is needed on the effect of adding moringa leaf extract *(Moringa oleifera)* and kencur *(Kaempferia galanga*) leaf extracts in feed is expected to be able to increase the growth of catfish seeds.

METHOD

Place and Time of Research

The research was carried out from February to March 2024, at the Aquaculture Laboratory, Building 4, Faculty of Fisheries and Marine Sciences, Padajajaran University. The production of moringa leaf extract (*Moringa oloifera*) and kencur extract (*Kaempferia galanga*) was carried out in the Central Laboratory of Padjadjaran University.

Tools and Materials

The materials used consisted of 300 catfish seeds ±5-7 cm long with a weight ranging from ±2 g, moringa *leaves (Moringa oleifera),* kencur *(Kaempferia galanga*), 70% ethanol, PF-1000 commercial feed, aquades, and binder in the form of progols. The tools used are digital scales with an accuracy of 0.01, *blenders*, sieves, plastic funnels, 2 L glass jars, Whatman 42 filter paper, measuring cups 1000 ml, *rotary vacuum evaporator*, 16 aquariums measuring 40x25x25 cm3, fiber tubs, aeration, heaters, mercury thermometers with an accuracy of 0.1°C, *DO*, pH meter, spray measuring 100 ml, *millimeter blocks,* and a ruler with a precision of 0.1 cm.

Moringa and Kencur Leaf Extraction

Moringa leaves (*Moringa oliefera*) and kencur extract (*Kaempferia galanga*) obtained are first washed with running water until clean and then dried in the sun for ± 3 days. Once dry in a blender to make simplisia. Simplisia, put in a container (jar) and add 70% ethanol solvent. The maceration process is carried out for 3x24

hours protected from light and direct sunlight until a clear supernatant is produced. Next, the maceration results are filtered using filter paper and stored in a liter jerry can tightly. The results of the maceration process are evaporated using *a vacuum rotary evaporator*. For the results of maceration of moringa leaves are evaporated at a temperature of 60°C at a speed of 65 rpm, while the results of maceration of kencur are evaporated at a temperature of 60°C at a speed of 70 rpm until the solvent evaporates and a thick extract of moringa leaves and kencur extract is produced.

Test Feed Manufacturing

Moringa leaf extract and kencur extract are dissolved with aqueous water and then put into a spray containing a binder in the form of progol as much as 2% of the feed weight (Rafsyanzani and Hidayatullah 2016). After that, it is beaten until homogeneous and mixed evenly on the entire surface of the feed by the *spray* method. After the solution is sprayed evenly on the feed, then dried, aired for ±1 day at room temperature and stored in a dry container that is tightly closed, add silica gel to keep the feed from being damp or moldy.

Preparation for Implementation

Each aquarium is filled with ±10 L of water, followed by the installation of aeration and *heater* installations, then 10 fish or a density of 1 fish/liter (Hidayah 2019) are put into the aquarium and acclimatized first for 7 days in the aquarium to adapt to the new environment and maintenance media. During the acclimatization process, the fish are fed (without the addition of extracts) with a feeding frequency of 3 times a day, then the weight of the fish's body is weighed to determine the initial weight and the dose of feed that will be given at the maintenance stage.

Research Implementation

The research is carried out for 40 days and observations are carried out every 10 days, including water quality measurement, weighing and measuring body length as well as weighing the feed that will be given to adjust the amount of feed in the next maintenance period. Feed is given 3 times a day, namely at 07.00 WIB, 12.00 WIB and 16.00 WIB. The amount of feed given is 5% of the fish biomass.

Research Methods

This study used a Complete Randomized Design (RAL) with 4 treatments and 3 replicates. The treatment given is as follows:

Treatment A : 100% commercial feed (No Extract Additive)
Treatment B : 100 mg/kg moringa leaf extract and 150 mg/kg kencur extract
Treatment C : 125 mg/kg moringa leaf extract and 200 mg/kg kencur extract

Treatment D : 150 mg/kg moringa leaf extract and 250 mg/kg kencur extract

Research Parameters

Absolute length growth (L)Δ

According to Hidayat et al. (2013) absolute length growth can be calculated using the formula:

$$\Delta L = Lt - Lo$$

Information:

ΔL = Growth of absolute length (cm)
Lt = Length of the fish at the end of the maintenance(cm)
Lo = Length of fish at the beginning of maintenance (g)

Absolute weight growth (W)Δ

According to Hidayat *et al.* (2013) absolute weight growth can be calculated using the formula:

$$\Delta W = Wt - Wo$$

Information:

ΔW = Growth in absolute weight (g)
Wt = Weight of fish at the end of maintenance (g)
Wo = Weight of the fish at the beginning of maintenance (g)
T = Duration of study (days)

Specific Growth Rate (*SGR*)

The Specific Growth Rate (SGR) is the percentage of average fish weight gain per day. Specific growth rates are formulated based on (Effendie 1997):

$$SGR = \frac{lnWt - lnWo}{t} x\ 100\%$$

Information:

SGR = Individual Daily Growth Rate (%/day)
Wt = Average weight of the test fish at the end of the study (g)
Wo = Average weight of the test fish at the beginning of the study (g)
T = Duration of study (days)

Feed Convertion Ratio (FCR)

Feed Conversion Ratio (FCR) is the ratio between the amount of feed consumed and fish biomass which can be calculated based on the formula (Effendie 1997):

$$FCR = \frac{F}{(Wt + D) - Wo}$$

Information:

FCR = Feed Conversion Rate

Wt = Average weight of the test fish at the end of the study (g)
Wo = Average weight of the test fish at the beginning of the study (g)
D = Weight of dead fish (g)
F = Weight of feed given (g)

Feed Efficiency

Feed efficiency is the ratio between the weight gain of fish obtained and the amount of feed consumed by fish. According to (Watanabe 1988) the formula for calculating feed efficiency is:

$$EP = \frac{(Bt + Bd) - Bo}{F} \; x \; 100\%$$

Information:
EP = Feed Efficiency (%)
Bt = Weight of fish biomass at the end of the study (g)
Bo = Weight of fish biomass at the beginning of the study (g)
Bd = Biomass weight of fish that died during the study (g)
F = The amount of feed the fish consumed during the study (g)

Survival Rate (*SR)*

According to Effendie (2002), *the survival rate* can be calculated by the following formula:

$$SR = \frac{Nt}{No} x \; 100\%$$

Information:
SR = Survival (%)
Nt = Number of final fish (tails)
No = Number of initial fish (tail)

Data Analysis

Growth parameter data was analyzed using ANOVA (Analysis of Varience Statistical Analysis (F test) with a confidence level of 95%, then Duncan further tests were carried out to see the influence between treatments. Data on survival rate and water quality were analyzed descriptively.

RESULT AND DISCUSSION

The addition of moringa leaf extract and kencur to feed affects the growth performance of catfish seeds (Table 1). The results of the Statistical Analysis using the ANOVA Test with a confidence level of 95%, on each growth parameter showed a value (F calculation > F table) which stated that the addition of moringa leaf extract and kencur to feed had an influence on the growth of catfish seeds. Based on the results of the Duncan Test, each treatment, namely A, B, C and D treatments, is significantly different from each other.

The addition of 150 mg/kg of moringa leaf extract and 250 mg/kg of kencur extract to feed affected the increase in high fish growth (P<0.05) from other treatments characterized by an increase in absolute length of 4.2±0.228 cm, resulting in an absolute weight growth of 57.58±0.60 g then significantly decreased the FCR value by 1.45±0.026%.

Table 1. Catfish seed growth performance.

Value Variable	Treatment			
	A	B	C	D
Absolute length (cm)	3,19 ± 0,228a	3,19 ± 0,128b	3,81 ± 0,151c	4,19 ± 0,094d
Bobot Absolute (g)	35,58 ± 0,71a	40,30 ± 0,54b	50,55 ± 0,40c	57,58 ± 0,60d
SGR (% in/hari)	2.90 ± 0.04a	3.13 ± 0.02b	3.54 ± 0.03b	3.80 ± 0.04c
FCR(%)	1.59 ± 0.07a	1.58 ± 0.06b	1.44 ± 0.04c	1.45 ± 0.03d
EPP (%)	63.10± 0.03a	62,98 ± 0,02a	69,37 ± 0,02b	68,90 ± 0,02c

*Different letters (notation: a, b, c, d) on the same line show a noticeable difference in influence between treatments

Information:

(A) : Commercial Feed (Without Addition of Extract) (B) : 100 mg/kg Moringa Leaf Extract and 150 mg/kg Kencur Extract (C) : 125 mg/kg Moringa Leaf Extract and 200 mg/kg Kencur Extract (D) : 150 mg/kg Moringa Leaf Extract and 250 mg/kg Kencur Extract

The addition of moringa leaf extract and kencur in feed was able to significantly increase the specific growth rate (SGR) than the feed with an EPP value of 68.90±0.02%, and showed that the EPP value was relatively good (more than 50%), (Craig and Helfrich) (P<0.05). Then it gives an SGR value of 3.80±0.04%/day.

Absolute Length Growth

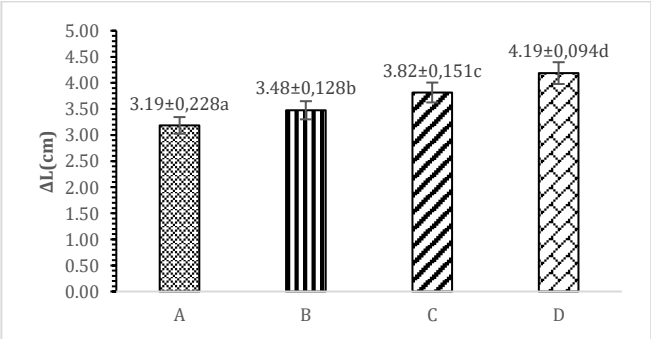

Figure 1. Absolute Length Growth

Based on the results obtained (**Figure 1**), it can be seen that the average length growth of catfish seeds shows that the treatment with the addition of

moringa leaf extract and kencur extract in feed experienced higher growth than the control treatment (100% commercial). The difference in the rate of addition of the average length of fish fry is suspected because the compounds in the added extract can increase the nutrient content in the feed given. Bioactive compounds contained in extracts such as flavonoids, carotenoids, terpenoids, phenolic acids, and alkaloids are known to improve fish growth performance (Ahmadifar *et al.* 2020). Syarif *et al.* (2022) states that feeding in accordance with the needs of fish can increase fish growth better, supported by the statement of Nores and Suharman (2020) that good quality feed can accelerate the growth rate of fish.

Growth in Absolute Weight

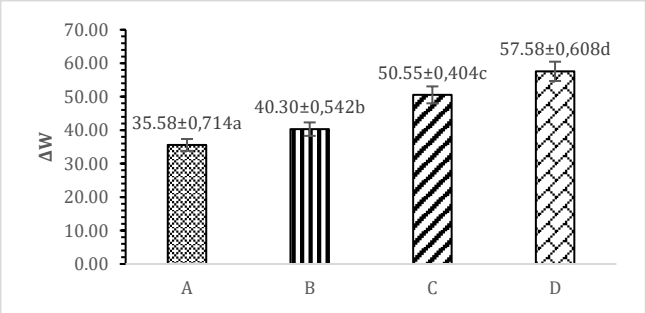

Figure 2. Growth in Absolute Weight

The growth of the average weight of catfish fry showed a good increase with the initial biomass weight of the study of 16 g to 57.58 g at the end of the study. Catfish seeds experienced different weight increases where treatment D had the highest average weight of 35.58 g. Followed by treatment C had an average weight of 40.30 g. Furthermore, treatment B has an average weight of 50.55 g. The lowest average weight of catfish fry was in the control treatment which had an average weight of 35.58 g. The treatment with the addition of moringa leaf extract and kecur extract in feed experienced a higher weight gain than the control treatment that was not given the addition of extract to the feed. The results of this study have a better value than the research of Hasibuan *et al.* (2021) for camba fish size 8-12 cm which was given the treatment of adding kencur to floating commercial feed with a dose of 200 mg/kg which resulted in an absolute weight of 20.19 g. This can be due to the addition factor of feed nutrients that are added in the form of bioactive compounds in which there are alkaloids and flavonoids in moringa leaves and phenols in kencur which provide aromatics to feed which can increase fish appetite. Puycha *et al.* (2017) said that the increase in fish weight was due to the presence of different bioactive components in the extract which played a role in increasing the utilization of nutrients in fish that were given extract treatment. In addition, according to Muntari (2015) the content contained in the feed is easier for fish to digest so that the fish only needs less energy for the

digestion process, so that the excess energy is used to increase the weight of the fish.

***Specific Growth Rate* (*SGR*)**

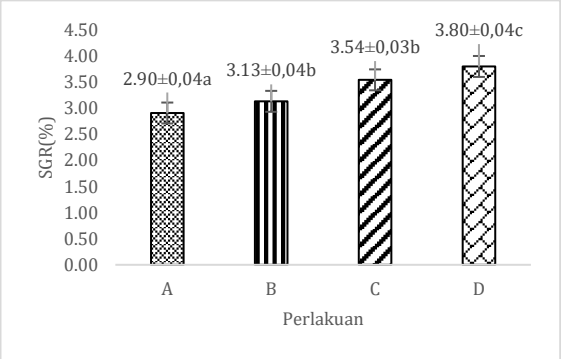

Figure 3. *Specific Growth Rate* (*SGR*)

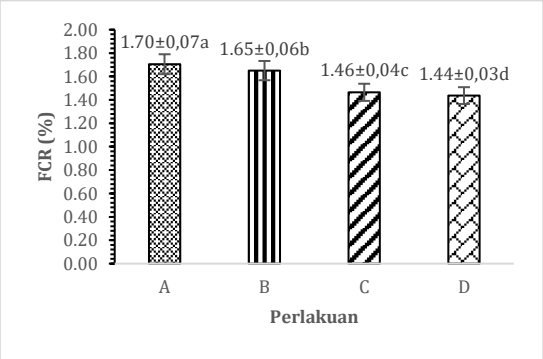

Figure 4. *Feed Convertion Ratio* (FCR)

The value of the daily growth rate is closely related to the growth of absolute weight, which means that the optimal increase in fish weight per unit of time can increase the value of the daily growth rate. Based on the research that has been conducted, it was found that the addition of moringa leaf extract and moringa extract to feed has a real influence on the daily growth rate of catfish seeds. The results of measuring the specific growth rate of fish during the study can be seen in (**Figure 3**). This can be proven by treatment D (150 mg/kg moringa leaf extract + 250 mg/kg kencur extract) which showed the highest increase in body weight, which was 3.80±0.04 and treatment A (100% commercial) showed the lowest weight increase, which was 2.90±0.04. The results of this study have a better value than the research of Fikri *et al.* (2023) which produced a specific growth rate of 3.62±0.12 with the addition of herbal supplementation (kencur, temulawak, ginger and turmeric) of 100 ml/kg in catfish feed and also in Fadillah (2023) research on catfish with the supplementation of moringa leaf extract 150 g/kg feed + Vit. E 200 mg/kg in feed that produces a growth rate of 2.55±0.34. The growth of catfish seeds can be seen from the increase in body weight and specific growth rate (SGR) value during the 40-day maintenance period. The addition of moringa leaf extract and kencur extract to feed can increase the weight of the fish, this is due to the bioactive compounds contained in the extract (flavonoids). According to Shakya (2017) the increase in growth rate is due to bioflavonoids, plant chemicals with estrogenic activity, which stimulate fish growth. This is in line with the opinion of Syawal *et al.* (2019) who stated in his research that one of the drivers of fish development is due to the ability of catfish seeds to be able to utilize nutrients in feed. The active flavonoid substances in moringa and kencur leaves reduce protein so as to increase protein digestibility in fish metabolism. In this study, treatment with 150 mg/kg moringa leaf extract and 250 mg/kg kencur extract in feed is the

optimal treatment for catfish, so that the feed provided can be used well for body maintenance and can meet the nutritional needs of fish.

***Feed Convertion Ratio* (FCR)**

Feed conversion ratio (FCR) (**Figure 4**) shows the efficiency of feed nutrient utilization by fish. Based on the results of the study, the FCR value obtained shows a downward trend. Treatment A obtained an FCR value of (1.70%), treatment B (1.65%), C (1.46%) and treatment D (1.44%). The lowest FCR value was found in the D treatment of 150 mg/kg of moringa leaf extract and 250 mg/kg of kencur extract with an FCR of 1.44 ±0.03 which means that to produce 1 gram of meat requires 1.44 kg of feed. The high or low value of the feed conversion ratio can be influenced by several factors, especially the quality and quantity of feed, fish species and fish size. So in this case, the addition of moringa leaf extract and kencur extract is believed to improve the quality and quantity of feed. Fikri *et al.* (2023) said that the low feed conversion value in the treatment is suspected to be caused by the absorption of feed by fish that is more optimal so that it is able to optimally convert feed into meat. Shakya (2017) also said that the low feed conversion value in feed treated with the addition of extracts is due to better feed utilization through increased secretion of digestive enzymes and higher deposition of fat and protein. Therefore, it can be concluded that moringa leaf extract and kencur in feed affect feed quality so that it is able to produce growth and affect the FCR value of fish, and the dosage of 150 mg/kg moringa leaf extract and 250 mg/kg kencur extract is the most optimal dose.

Feed Efficiency

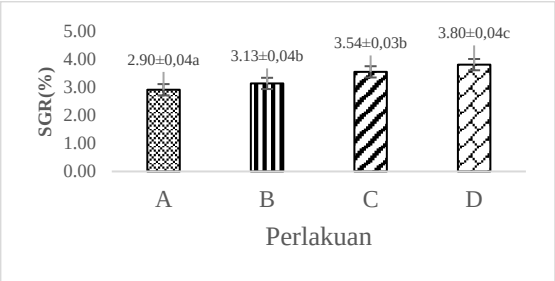

Figure 5. Efisiensi Pakan

Based on Figure 5, treatment A is the treatment with the lowest feed efficiency value when compared to treatment B, C and D with a value of 58.68%±0.03, while treatment D has the highest feed efficiency value of 68.90%±0.02. The better the quality of a feed, the higher the feed efficiency value produced. The high feed efficiency value shows that the feed given can be digested and utilized properly by the fish so that the body weight produced increases. The addition of moringa leaf extract to feed can increase the value of feed efficiency because the addition of moringa leaf extract can improve the digestive system and

appetite in catfish seeds. Sumarjan *et al.* (2022) states that moringa leaves are plants that contain high enough protein for growth and contain flavonoids, saponins, and vitamins A, B, C, and E which can trigger body resistance and can increase feed digestibility in the intestines of fish, so that the absorption of nutrients in feed can be perfectly absorbed. However, in some research results with the use of moringa leaves and kencur in fish feed, resulting in a decrease or inhibition of poor growth and feed utilization performance. This is because too much anti-nutrient factors such as saponins and tannins that are not easily digested are characterized by a bitter taste that negatively affects the delicacy of feed, resulting in low feed consumption (Hany *et al.* 2023). The existence of higher levels of phenolic substances that cause a decrease in protein digestibility and the availability of essential amino acids through the formation of complexes (Richter et al., 2003). In this study, the feed efficiency value in each treatment was classified as good because it exceeded 50% (Craig and Helfrich 2002).

Survival Rate (SR)

The Survival Rate (SR) is presented in Table 2. Each treatment shows the same percentage, which is 100%.

Table 2. The survival rate of catfish fry

Treatment	Survival rate (%)
A (100% Commercial Feed)	100%±0.00
B (100 mg/kg moringa leaf extract and 150 mg/kg kencur extract)	100%±0.00
C (125 mg/kg moringa leaf extract and 200 mg/kg kencur extract)	100%±0.00
D (150 mg/kg moringa leaf extract and 250 mg/kg kencur extract)	100%±0.00

Based on (Table 2) there is no real effect of the addition of moringa leaf extract and kencur on feed on the survival of catfish seeds. This is suspected because the fish have been well civilized to the maintenance medium. Factors that can affect the survival rate of fish are dense stocking, water quality, feed quality and disease. The stocking density of fish in a rearing container containing ten fish (1 head/liter) is the carrying capacity for the survival rate, where the stocking density was conveyed by Hidayah (2019), the stocking density of 10 fish/liter is the optimal stocking density for the maintenance of catfish seeds. This is in line with Pranata *et al.* (2017), low stocking density is the carrying capacity for growth and survival rate due to the low level of competition in movement space, feed and oxygen. Catfish is a cannibal fish, so with a high stocking density will cause a high interaction from the fish, the higher the cannibalism, so that survival will also be low. In addition, the provision of supplements is able to increase the immunity of the fish body and fish become healthier, as shown by the high consumption of feed every day. According to Syawal *et al.* (2019), the administration of supplements

mixed with pellets can trigger fish growth and reduce mortality rates. The efforts made to maintain the quality of the maintenance media during the research are by using *a heater* that is set at a temperature of 28°C so that the temperature of the maintenance container remains stable, as well as removing fish droppings that settle in the aquarium and replacing water by 30%-50% (KKP 2012). Then, the fish are fed according to the treatment three times a day with the stipulated conditions.

Water Quality

Table 3. Range of water quality during the study

Treatment	Water Quality Parameters		
	Heat (°C)	pH	OD (mg/l)
A	27,5-28,2	7,0-7,3	5,8-7,3
B	27,8-28,2	7,0-7,6	5,9-7,1
C	27,8-28,1	7,0-7,4	5,6-6,7
D	28,1-28,3	7,0-7,5	5,2-7,5
Optimal SNI (2002)	25-30	6,5-8,4	>4

Information:
(A) : Commercial Feed (Without Addition of Extract) (B) : 100 mg/kg Moringa Leaf Extract and 150 mg/kg Kencur Extract (C) : 125 mg/kg Moringa Leaf Extract and 200 mg/kg Kencur Extract (D) : 150 mg/kg Moringa Leaf Extract and 250 mg/kg Kencur Extract

Based on the data from the measurement of water quality parameters (Table 3), the water quality range values between treatments A, B, C and D did not experience any significant difference because the four treatments were carried out in the same place and environmental conditions (homogeneous). It was seen that the average temperature of each treatment had a range of 27.5-28.3°C, an average pH of 7.0-7.6 and an average dissolved oxygen content of 5.2-7.5 mg/l. Fish maintenance is maintained as much as possible in optimal conditions, this affects the metabolism of fish, so that the fish's appetite can be well maintained. Rojo *et al*. (2018) states that good quality of maintenance water has an impact on increasing the growth rate of fish, but on the other hand, if the water used in aquaculture has been polluted or exceeds the normal threshold for aquaculture, then the fish will be very susceptible to diseases or parasites that live in the water.

CONCLUSSION

The results of this study showed that there was a significant effect of the addition of moringa and kencur leaf extracts in feed on growth, absolute length, absolute weight, specific growth rate, feed conversion and feed efficiency in catfish. The best treatment was obtained at the additional dose of 150 mg/kg moringa leaf extract and 250 mg/kg kencur extract in feed with the values of absolute length growth percentage (4.2 cm), absolute weight (57.58 g), SGR (3.80%), FCR (1.44%), EPP (68.90%), and SR (100%). The water quality values during fish rearing are in

the optimal range including temperature (27.5-28.3°C), pH (7.0-7.5), and DO (5.2-7.5 mg/L).

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