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Effect of Led Light Intensity on Survival Rate and Growth Rate of Cantang Grouper Larva in Indoor Cultivation

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Abstract. This study aimed to examine the effect of (1) the intensity of LED light on the survival rate of Cantang grouper larva in indoor cultivation (2) the intensity of LED light on the growth rate of Cantang grouper larva in indoor cultivation. This research is an experimental research type. The subjects in this study were Cantang grouper larva in Penyabangan Village, Buleleng Regency using microscopic observations which were analyzed descriptively and recorded in the table. The data analysis technique used in this study uses SPSS Windows version 21 by using the normality test, the Kruskal walls test and the post hoc test. The results of this study indicate that (1) The intensity of LED light affects the survival rate, this can be seen from Pool 3 filled with 2.000 LUV LEDs which has the highest SR level, which is 5%. (2) The intensity of the LED light affects the growth of the larva studied by using the parameters of length and the percentage of feed consumed in the larva's stomach. This is indicated by the length and the highest percentage of fish larva belly in pond 3 which was treated with 2.000 LUX LED.

Keywords: Cantang grouper aquaculture; light intensity; growth rate; survival rate

I. INTRODUCTION

Data in 2020 reports that, currently the number of aquaculture companies is increasing every year, but the highest number of aquaculture companies was in 2018 [2]. With the large potential for fisheries and marine affairs, it should be an impetus to be more focused and serious about increase aquaculture production.

Aquaculture is an activity carried out to produce biota by adding input and energy to increase the production of useful aquatic organisms by manipulating their growth, mortality and reproduction rates [6]. One of the fish currently cultivated by cultivators is grouper.

Grouper fish is a commodity that has a high economic value, because currently fishery resources that are being utilized on a large scale are reef fish commodities, such as grouper [4]. Cantang grouper (Epinephelus fuscoguttatus-lanceolatus) is a type of marine fish that has high economic value and can be developed into a promising aquaculture commodity. Cantang grouper is a reef fish that has high economic value and has become an important export commodity, especially to Hong Kong, Japan, Singapore, and China. Cantang grouper (E. fuscoguttatus-lanceolatus) is the result of a cross between tiger grouper (E. fuscoguttatus) and Kertang grouper (E. lanceolatus).

The success of cultivators in the hatchery process is the most concerned with water media, cultivation containers, and indoor/outdoor places. To deal with erratic weather such as cloudy weather, cold air, strong winds, it is not appropriate if it is used for fish hatchery, outdoor especially the temperature in the cultivation media will drop, resulting in a lot of dead fish seeds, especially the age of fish larva less than 30 days. To overcome this, indoor cultivation is carried out. Indoor cultivation or a closed system is cultivation that is carried out in closed waters such as ponds, ponds, or carried out indoors with containers such as aquariums and tubs [6].

The problem that often occurs in grouper cultivation is the slow growth rate of grouper. The delay in the growth rate can be influenced by external factors, one of which is the lack of light intensity, thus affecting the behavior of natural feed not moving vertically upwards due to lack of

lighting. Therefore, this company is trying to use LED light intensity in indoor cultivation with the aim of obtaining better results.

The intensity of light is one of the factors that affect the behavior of fish in foraging and preying on each other. In this study, the treatment given was different light intensity in each rearing tank. There are 2 kinds of light intensity used, namely 1.000 lux, and 2.000 lux. The intensity of the light greatly affects the level of feeding efficiency of fish larvae. It is caused by higher light intensity will affect the behavior of natural feed by moving vertically upwards approaching the light on the surface of the water so that the opportunity for feed predation naturally be the larger, considering that the activity of the larva in catching prey using the visual feeder because the larva is active in catching prey in bright light [5].

The aims of this study were (1) to determine the effect of LED light intensity on the survival rate of Cantang grouper larva in cultivation indoor. (2) To determine the effect of LED light intensity on the growth rate of Cantang grouper larva in cultivation indoor.

II. RESEARCH METHOD

Type of research used is an experimental research approach. The experimental design used was a completely randomized design (CRD) with 3 treatments and 3 repetitions. The treatments used in this study included Tank 1 (without light intensity), Tank 2 (giving light intensity 1000 lux), and Tank 3 (giving light intensity 2000 lux). This research was conducted at Penyabangan Village, Gerokgak District, Buleleng Regency. This research was carried out for 30 days in February 2020.

This study consisted of two types of LED light intensity provided, namely 1000 lux and 2000 lux (with a differentiated portion of lux LED). This study aims to determine how much influence the use of LED light intensity has on the survival rate and growth rate of Cantang grouper larva in cultivation indoor.

The population in this study were Cantang grouper larva at Penyabangan Village, Buleleng Regency, where each maintenance tank is 2 tons filled with 40 thousand seeds per tub. Sampling was carried out with a 500 ml measuring cup and 3 replicates every 7 days for 30 days.

Data processing in this study used SPSS for Windows version 21. The data obtained from the sampling were recorded, collected and tabulated. If later the results of the data are normal then use ANOVA and if the results of the data are not normal then use non-parametric with the Kruskal Wallis test method, and further test.

III. RESULT AND DISCUSSION

Results

The Effect of LED Light Intensity on Survival Rate

From the Table I, it can be explained that the seeds distributed in each rearing tank (Tank 1, Tank and Tank 3) were as many as 40,000 larvae, so that the results were obtained as shown in the table above.

The Effect of LED Light Intensity on Growth Rate Cantang Grouper Larva Size

Based on the results of the tests that have been carried out, it was found that the test with Asymp. Sig. 0.001 < 0.05, so Ho is rejected and Ha accepts, meaning that there is a difference of at least one group with different sizes due to the influence of LED light intensity.

Stomach Contents Cantang Grouper Larva

Based on the results of the tests that have been carried out, it was found that the Kruskal Wallis test with Asymp. Sig. 0.010 < 0.05, so Ho was rejected, and Ha accepted, meaning that there was a difference of at least one group that differed in the stomach contents of Cantang grouper larva due to the influence of LED light intensity.

In the two tables above, there are differences in larval growth due to the influence of LED light, so it will be continued by conducting Post Hoc tests or further tests to find out which groups have significant differences, and the results are as shown in the table below.

From the Table II, it can be concluded that Tank 1 and Tank 2, Tank 1 and Tank 3, and Tanks 2 and 3 there are significant differences in the growth rate of Cantang grouper larva.

From the table III, it can be concluded that Tanks 1 and 2 and Tanks 1 and 3 have significant differences in the stomach contents of Cantang grouper larva, while Tanks 2 and 3 have no significant differences in the growth rate of Cantang grouper larva stomach contents.

Discussion

Cantang Grouper Cultivation Cantang Indoor

Grouper cultivation at Penyabangan uses indoor method. This Cantang grouper cultivation has specifications such as good water quality, high protein feed and superior seeds in accordance with the SNI for Grouper Cultivation.

Good water quality for grouper growth, such as an ambient temperature between 28-3228-32^{o}C, salinity between ppt, dissolved oxygen at least 4 mg/L and an ambient pH between 7.5 - 8.3 [3]. While the quality of the water used in grouper cultivation includes temperature (24-31oC), pH (7.8-80), salinity (30-33 ppt), DO (Min 4 mg/L), so that the water quality can be said to have met the SNI for Grouper Cultivation.

One of the other very important factors in fish farming is the feed factor, both artificial feed and natural feed, because it is very important for the success of fish farming business so it is very decisive in the growth and development of fish, if the feed is given in sufficient quantities and of good quality. it will give a good impact for maximum fish quality.

In the cultivation carried out at this company, the feed used is natural feed in the form of artemia and rotifers because it has a very small size and has a very high protein content, so it can provide very fast larval growth and have effect major on the survival of the Cantang grouper larva cultivated. The egg handling process is very strict on biosecurity.

Biosecurity is carried out to prevent the entry of diseases that can later be harmful to the cultivated biota. Both for technicians and for biota, biosecurity in this company should not be missed even one step. So that the company has superior seeds in accordance with the SNI for Grouper Cultivation.

The Effect of LED Light Intensity on Survival Rate of Cantang Grouper Larva

Survival Rate (SR) is the number of fish that can survive during the maintenance period. In this study, the larval rearing period of Cantang grouper lasted for 30 days. The results showed that the SR values ranged from 1% to 5%. This is influenced by the intensity of the light given. The treatment given to each rearing tank was different, on Tank 1 (control tank) the treatment was given without using the slightest light intensity, on Tank 2 the treatment was given using an LED light intensity of 11000 lux and on Tank 3 with a light intensity LEDs of 2.000 lux. Successively obtained SR percentage results of 1%, 2% and 5%, so that the highest SR value is found in Tank 3 which uses the largest LED light intensity.

The high percentage value of survival rate (SR) in Tank 3 is due to the quality of the light intensity provided is very large so it is very helpful for the survival of Cantang grouper larva. Survival rate of a cultured aquatic organism can survive if environmental conditions are influenced by stable and large light [9]. On the other hand, there is a decrease in survival (the percentage value of the SR obtained is small) because aquatic organisms experience stress due to failure to adapt to environmental conditions with little or no light. Therefore, in control tanks with poor intensity, the survival of Cantang grouper larva is increasingly threatened.

The survival and growth of larva performance resulting in good performance due to the influence of light and the type of food given [11]. Variations in the percentage obtained will vary depending on the dose and the conditions of the research environment. Water quality is an important factor in grouper cultivation. Measurement of water quality is carried out so that water quality is monitored and suitable for fish hatchery activities. The measured water quality includes temperature, salinity, DO and pH. Measurement of water quality during fish rearing is very important to know the symptoms that occur as a result of changes in one of the water quality parameters. Good aquatic environmental conditions support the survival of fish during the maintenance period, whereas unfavorable aquatic environmental conditions can have a detrimental impact on survival [12].

The quality of the grouper seeds used is very important in supporting the survival of the larva. If the quality of the Cantang grouper seeds used is high, then the cultivation yield is also maximized. Conversely, if the seeds used have low quality standards, it will have an impact on low cultivation yields as well. Another thing that greatly affects the survival of Cantang grouper larva is feeding. In this cultivation, the feed used is natural feed in the form of Artemia and rotifers because it has a very small size and very high protein content so that it can provide very fast larval growth and have a major effect on the survival of the cultivated Cantang grouper larva. The survival of aquatic organisms will be high if all treatments are carried out properly [1]. In the results of the study by the authors, the smallest scale value is 1%, therefore to avoid a decrease in the quality of larva and their survival, the solution offered is the management of a favorable tank environment during the experiment in terms of light intensity and other factors.

The Effect of LED Light Intensity on Growth Rate Cantang Grouper Larva

Research uses 3 maintenance tanks with different treatments in each tank. Tank 1 or control tanks were not given any treatment because they were used as a comparison against Tank 2 and Tank 3. On the same date there were 10 data because on the same day 10 objects were taken in one tank, so the age of the fish and the date of sampling were in one such day there is no difference. Then the place is also all different. The difference is the control tank, without light, Tank 2 uses 1000 lux LED light and Tank 3 uses 2000 lux LED light. The big difference in lux Tank 2 and Tank 3 was done because they wanted to see how much light intensity given could affect the growth of larva. There have been many previous studies using this method, but there is a slight difference in this study, namely using Cantang grouper.

The results of hypothesis testing showed that the intensity of LED light on the growth rate of Cantang grouper larva had a positive and significant effect. Where mostly there are differences between Tank 1, Tank 2 and Tank 3 both from size data and from stomach contents data for Cantang grouper larva, this indicates H0 is rejected and

H2 is accepted, so that there is an effect of LED light intensity on the growth rate of Cantang grouper larva. In cultivation indoor. On Tank 3, it has a significant difference in size against Tank 1 and Tank 2, and has a significant difference in entrails with Tank 1. On Tank 2, it has a significant difference in size against Tank 1, and has a significant difference in stomach contents with Tank 1 The fastest growth rate was the Cantang grouper larva in Tank 3, while the slowest was the Cantang grouper larva in Tank 1.

The results of the LED light intensity study on the growth rate of the Cantang grouper larva showed that the brighter and longer the lighting was given, it would have an impact on increasing larval growth. The use of different light intensities on Cantang grouper larva can have an influence on the development and growth rate of Cantang grouper [10]. The brighter the environmental conditions, the greater the predation response to natural feed, this can increase the growth of the larva. The length of lighting (Photoperiod) is one of the direct factors that affect the growth of fish during the larval stage, starting from the endogenous feeding pattern and the efficiency or availability of food. Research shows that the availability of light is very important in the larval rearing process, especially in relation to the predation ability of natural feed given to Cantang grouper larva [8].

In addition, research indicate that the intensity of light provided during the rearing process of Cantang grouper larva can affect grouper seed survival [7]. Where the amount of light given also affects growth hormone through the retina of the eye, it will be transmitted through the eye nerve to the anterior hypothalamus, so that secreted Somatotropic Hormone Releasing Factor (STH-RH) and Thyrotropic Releasing Hormone (TRH) are. Releasing these factors will stimulate the anterior pituitary gland to secrete STH (*Somatotrop Hormone*) and TSH (*Tyroid Stimulating Hormone*). TSH will stimulate the thyroid gland to release thyroxine. STH and thyroxine will stimulate the body to increase its growth activity.

IV. CONCLUSION

Based on the results of the analysis used and the in-depth research discussion in the previous chapter, the conclusions from this study are that (1) The intensity of LED light affects the survival rate, this can be seen from Pool 3 filled with 2,000 LUV LEDs which have the highest SR level, i.e., 5%. (2) The intensity of the LED light affects the growth of the larva studied by using the parameters of length and the percentage of feed consumed in the larva's stomach. This is indicated by the length and the highest percentage of fish larva belly in pond 3 which was treated with 2,000 LUX LED.

From the description and conclusions obtained, there are also limitations and obstacles in this study, such as the scope of the study was limited to three tanks with different treatments, where there was one tank that was tested without LED light and 2 other tanks using different LED light assistance. in each maintenance tank. In addition, this study limits the use of the LED light used. The LED light used on tank 5 is 1.000 lux, and on the tank is 2.000 lux.

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TABLE I
AVERAGE SURVIVAL RATE RESULTS

No	Observation	Survival Rate (Tail)			Average
		1	2	3	
1	Tank 1	400	450	550	466,6
2	Tank 2	800	700	1.000	833,3
3	Tank 3	2.100	2.200	2.000	2.100,0

TABLE II
POST HOC TEST RESULTS CANTANG GROUPER LARVA SIZE

Tank	Repetition		
	1	2	3
1	-	Different Significantly	Different Significantly
2	Different Significantly	-	Different Significantly
3	Different Significantly	Different Significantly	-

TABLE III
POST HOC TEST RESULTS STOMACH CONTENTS CANTANG GROUPER LARVA

Tank	Repetition		
	1	2	3
1	-	Different Significantly	Different Significantly
2	Different Significantly	-	Not Different Significantly
3	Different Significantly	Not Different Significantly	-