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CULTURE PRODUCTIVITY OF *Daphnia magna* FED WITH QUAIL DROPPINGS (*Coturnix coturnix*)

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ABSTRACT

This research aimed to know the effect of quail manure on an abundance of *Daphnia magna*. The research method for *D. magna* was a Completely Randomized Design (CRD) with four settings, each repeated four times, namely the use of P0 (Control without fertilizer), P1 (Quail manure fertilize 1 g/L), P2 (Quail manure fertilize 3 g/L), P3 (Quail manure fertilize 5 g/L). *D. magna* was cultured for 15 days in a container with a volume of 3 liters. The updated parameters were abundance of *D. magna*, mortality of *D. magna,* and water quality. The results were analyzed using ANOVA analysis. The results showed that the highest abundance was in P2 (3g / L), and the lowest was in P0 (control). Water quality during the research was temperature 21-24°C, pH 7,5-8,4, DO 6,2-7,8 ppm, and ammonia 0-0,25 mg/L.

INTRODUCTION

Feed is one of the components that significantly supports aquaculture business activities, so the available feed must be adequate and meet the needs of fish, both the number and quality of larvae, fry, and broodstock (Listiowati & Pramono, 2014; Marnani & Pramono, 2017; Andriani et al., 2022). At the hatchery stage, the success factor for the fish hatchery stage is the availability of natural food for the larvae (Cahyono et al., 2015).

In the larval phase, fish larvae generally experience a process of organ development or organogenesis (Pramono et al., 2022), including eye spots, formation of mouth openings, digestive tract and body pigmentation (Soedibya & Pramono, 2018). The organogenesis process is critical in the hatchery business (Sontakke et al., 2019). During the organogenesis process, a strategy for providing appropriate natural feed according to the mouth opening size is needed (El-Feky & Abo-Taleb, 2020). so that after the egg yolk runs out, the larvae can immediately get food (Soedibya & Pramono, 2018). This guarantees good larvae or seeds' quantity, quality, and continuity.

Natural feeds are recognized as having advantages in a complete nutritional composition and enzymes that can support the development and growth of larvae (Wang et al., 2008; Simhachalam et al., 2015; El-Feky & Abo-Taleb, 2020). One of the recommended natural feeds to be developed in hatcheries is *Daphnia magna* (Zahidah et al., 2012; El-Feky & Abo-Taleb, 2020). The effort that needs to be made is to culture Daphnia using nutrients from

organic matter. In general, fertilizers used as organic matter are chicken manure (Huri & Sfariadiman, 2007; Zahidah et al., 2012), quail manure (Herman et al., 2018), yeast (Jusadi et al., 2005), aquaculture waste fish (Daharmawan, 2014), and cow dung (Andriani et al., 2022). However, quail manure has a higher total N-content of 2.86% and other nutrients, namely nitrogen 0.061%, protein 21%, P2O5 0.209%, and K2O content of 3.133% (Huri & Syafriadiman, 2007). Applying quail manure is important to evaluate the optimum concentration in increasing the high yield of Daphnia.

METHODOLOGY

This research was conducted in June-July 2020 at Mitra Aquarium, Purbalingga Regency. The object used in this research is *Daphnia magna* which is approximately 2 mm. The *Daphnia magna* seeds were obtained from natural feed sellers in Padamara Village, Purbalingga, Central Java. The total *Daphnia magna* used was 960 individuals.

The research method was carried out by RAL (Completely Randomized Design) with 4 treatments, and each treatment was repeated 4 times. The treatment in this study refers to research conducted by Utami (2018). The treatment carried out in this study were:

P0 : Control with non-fertilized media
P1 : Culture media fertilized with quail manure 1 g/L
P2 : Culture media fertilized with quail manure 3 g/L
P3 : Culture media fertilized with quail manure 5 g/L

Media Culture Preparation

In this study, culture containers for the maintenance of Daphnia magna used aquariums with a volume of 3 L of water filled with 16 aquariums complete with an aeration system. The culture begins with fertilization using dried quail feces. Dried quail feces is placed in a plastic container according to the treatment dose. A plastic container filled with quail manure fertilizer is perforated and placed in the culture medium. Maintenance was carried out for 15 days, and sampling was conducted daily (time series).

Observations of the Abundance of *Daphnia magna*

The number of individuals obtained using sampling with a beaker glass volume of 100 ml (3 times) before taking the individual media is stirred first so that the distribution of *Daphnia magna* is even. Maintenance is carried out for 15 days; no water replacement is in the maintenance container. Sampling was carried out for each treatment unit 16 times, then counted manually using a flashlight, and then recorded the calculations' results. The abundance of *Daphnia magna* is calculated using the formula K=L/l x A, where K is the abundance of *Daphnia magna*, L is the volume of culture media water (L), and l is the sampling water (L). A is the average *Daphnia magna* from the sampling calculation (ind/L).

Water Quality Data

Water quality as a supporting parameter in this study includes temperature, pH, ammonia, and dissolved oxygen (DO). Temperature measurement uses a temperature-measuring device, namely a Celsius thermometer. The water temperature is measured by immersing the thermometer for ±1 minute until the temperature shows a constant number, then recording the results. The pH measurement is carried out using a digital pH meter; the pH meter is immersed in water then a number will appears, recording the results. While

dissolved oxygen (DO) was measured using a DO meter. Ammonia was measured using the Ammonia Testkit. Temperature and pH measurements were carried out every day. At the same time, dissolved oxygen was measured three times in the beginning, in the middle, and at the end of maintenance. Meanwhile, ammonia was calculated at the beginning of the research, in the middle of the study, and at the end.

Data Analysis

The data obtained is data on the abundance and quality of water. The data is presented in the form of tables and graphs. Abundance data were analyzed using ANOVA, and a BNJ follow-up test was carried out to determine differences in abundance in each treatment unit. Water quality data were analyzed descriptively. Data analysis using SPSS data processing software.

RESULTS

Population Abundance of *Daphnia magna*

The results of *Daphnia magna* population abundance for each treatment for 15 days are presented in Figure 1 and Figure 2 as follows:

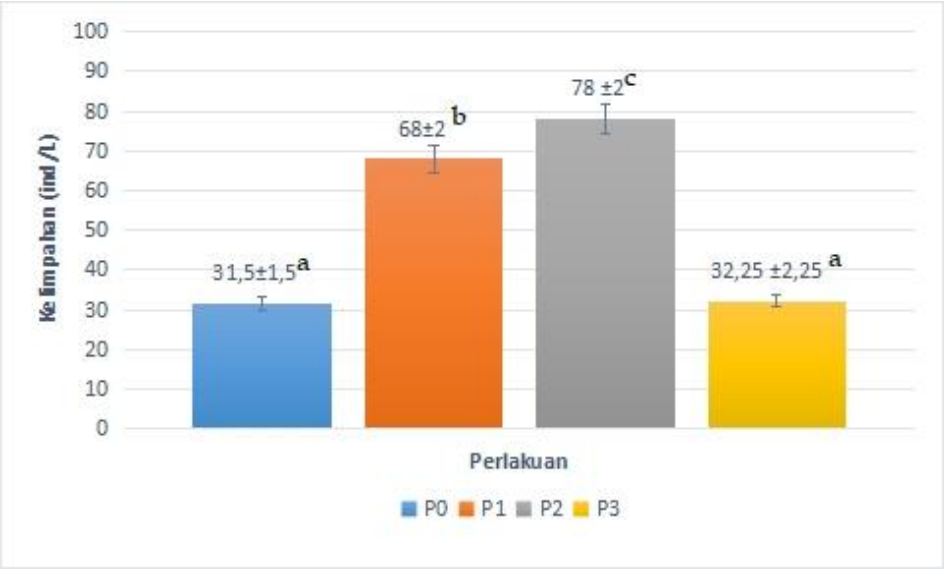

Figure 1. Graph of peak population abundance of *Daphnia magna* for each treatment for 15 days (results followed by different letters indicate a significant difference)

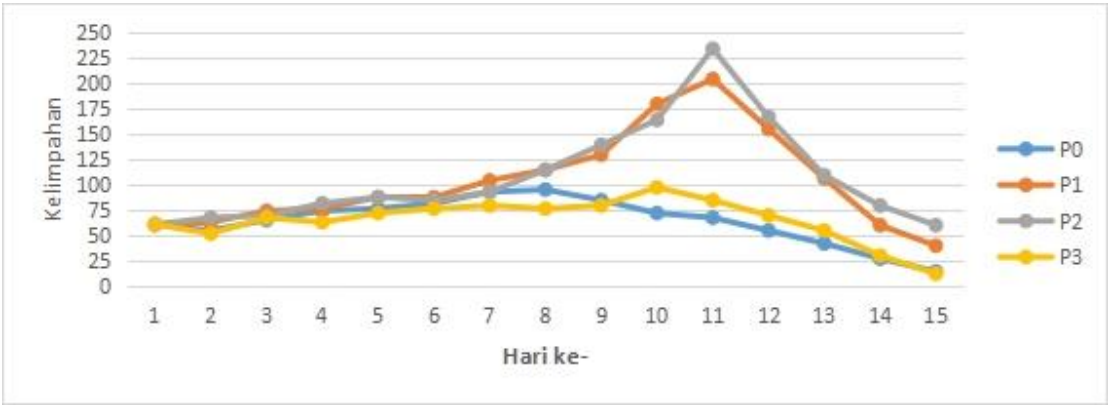

Figure 2. Graph of *Daphnia magna* population abundance for 15 days of rearing given quail droppings with different concentrations

Note:
P0 : Control with non-fertilized media
P1 : Culture media fertilized with quail manure 1 g/L
P2 : Culture media fertilized with quail manure 3 g/L
P3 : Culture media fertilized with quail manure 5 g/L

Water Quality

The results of water quality measurements in the form of temperature, pH, DO, and ammonia during the study are presented in Table 1. As follows:

Table 1. Results of water quality measurements

Treatments	Water Quality			
	Temperature (°C)	pH	DO (ppm)	Ammonia (mg/L)
P0	21-23	8,2-8,6	6,8-7,4	0
P1	21-24	8,1-8,4	6,9-7,3	0-0,1
P2	22-24	7,9-8,5	6,2-7,4	0-0,2
P3	22-24	7,5-8,5	6,6-7,8	0-0,25

DISCUSSION

The results of the analysis of variance (ANOVA) showed that the treatment of giving quail droppings at different doses had a significant effect on the abundance of *Daphnia magna* ($P<0.05$). The highest abundance was in treatment P2, and the lowest was in treatment P0. Based on the results of further tests using BNJ, it was shown that the P2 treatment was significantly different from P0, P1, and P3, the P1 treatment was significantly different from P0 and P3, the P0 treatment was not significantly different from P3 in terms of the abundance of *D. magna* (Figure 1). Research on the population abundance of *Daphnia magna,* which was carried out for 15 days of rearing by giving different quail droppings (0g/L, 1g/L, 3g/L, and 5g/L), showed that each treatment experienced a change in population numbers. The abundance of *D. magna* populations for 15 days can be seen in Figure 2.

Based on the study's results, the daily population abundance of *Daphnia magna* at P0, P1, P2, and P3 showed increased population numbers. Differences in population increase were seen every day at P0 until the 8th day; at P1 and P2, it increased until the 11th day, and at P3, it increased until the 10th day. After that, *D. magna* experienced a drastic decline. *D. magna* decreased on P0 on the 9th day until the 15th day, P1 and P2 on the 12th day until the 15th day, and P3 on the 11th day until the 15th day.

The adaptation phase is adjusting to the culture media, which takes place at the start of maintenance. Each treatment's adaptation phase occurred from day 1 to day 3. *Daphnia magna* does a doubling time (generation time) every 4 days, which is thought to result in the adaptation phase occurring from day 1 to day 3. The exponential phase is the increase in the number of individuals of *D. magna* to several times in a specific time. According to Suprimantoro (2016), the increase in the population of *D. magna* after day 3 is due to a parthenogenetic reproductive process that produces new individuals of *D. magna* and takes place under appropriate environmental conditions of rearing media. In the treatment P0, P1, P2, and P3, the exponential phase began on the 4th day.

The stationary phase is the peak phase of the *Daphnia magna* population. The stationary phase lasts briefly on the 9th to 11th day of rearing. The stationary phase generally describes

the peak of population growth until the drastic decline in population numbers resulting from mass mortality (Darmawan, 2014).

The stationary phase at P0 occurred on the 8th day with an abundance of *D. magna* population reaching 31.5 ± 1.5 ind/L, P1 occurred on the 11th day with an abundance of *D. magna* population reaching 68 ± 2 ind/L, P2 occurred on the 11th day with an abundance of *D. magna* population reaching 78 ± 2 ind/L, and P3 occurred on the 10th day with an average population abundance of *D. magna* reaching 32.25 ± 2.25 ind/L, this is consistent with the statement of Suningsih et al. (2012) that the peak population of Daphnia spp, namely at a dose of 3 g/L of quail manure. While the lowest abundance was in treatment P0 (control with non-fertilized media), treatment P0 was not given fertilizer. Hence, nutrients for the survival of *D. magna* were available in small quantities. The abundance of the *Daphnia magna* population, which reached its peak, caused a high population density, so the available nutrients decreased. The very high increase in the abundance of *D. magna* caused the space for movement in the culture media to become narrower and more limited, thereby inhibiting the reproduction of *D. magna*. *D. magna* that dies will accumulate with the rest of the feed that is not utilized. This makes it toxic because it settles to the bottom it affects the quality of the cultural media (Firdaus, 2004). This was proven because each container of culture media had turned brown and cloudy. According to Mubarak (2009), in his research, the ammonia content, which has toxic properties in rearing media, comes from the decomposition of organic matter, metabolic waste, which produces urine and feces, as well as feed residue, which is not utilized by *D. magna*.

The death phase is the death rate of *Daphnia magna,* which is higher than the survival rate of *D. magna*. The death phase was marked by a drastic decrease in the population of *D. magna* in a short time in the rearing medium. This death occurred due to the high density of *D. magna* in the cultivation media, which resulted in competition for survival. The death phase also occurs when the available feed is too little to meet the needs of the very abundant population of *D. magna*, causing a decrease in population density and resulting in competition to obtain food. Sarida (2007) states that if the density of *D. magna* is too high, the metabolic activity will increase, and the ammonia content will also increase so that the need for oxygen will also increase. In this competition, some *D. magna* that can adapt will survive, while the weak ones will die. According to Andriani et al. (2022), the death phase or declination phase in *D. magna* occurs due to a decrease in the water quality of the culture media, a reduction in the number of nutrients, population abundance, and age of *D. magna* because, at the age of 4-5 days, *D. magna* has become an adult. The factor that causes mortality is that the population abundance of *D. magna* has decreased; that is, the more population in the culture media, the more nutrients it needs.

Water's physical and chemical properties significantly affect organisms' life in the culture media. Several physicochemical factors include temperature, dissolved oxygen, pH, and ammonia. This factor needs to be known in advance by tabulating vitality parameter criteria that support the survival and development of each type of fish, then compared with the physical and chemical parameters of the existing waters (Syafei, 2005). Water quality is very important in maintaining *Daphnia magna* because it will determine the results obtained.

The temperature in the *Daphnia magna* culture medium was observed daily for 15 maintenance days ranging from 21-24°C for all treatments. It was still within the optimum temperature range for *D. magna*. This follows the research of Mubarak et al. (2009), who stated that the 21-28°C temperature range is included in the range supporting the normal growth of *D. magna*. The stable temperature during maintenance is because the place for

culturing *D. magna* is indoors, so the room temperature is controlled. If the temperature in the culture medium is outside the optimum temperature range, *D. magna* tends to be dormant (does not reproduce) (Radini, 2006; Mubarak et al., 2009).

The pH (Potential hydrogen) value was observed every day for 15 days of rearing. The pH value of the control and the quail droppings treatment ranged from 7.5 to 8.4. This shows that applying fertilizers with different doses does not significantly affect the pH value during maintenance. This is following the reference; the pH range that can be tolerated by *D. magna* is 7.2-8.5 (Clare, 2002).

Dissolved oxygen (DO) in the rearing medium was measured at the study's beginning, middle, and end. Dissolved oxygen that was not given quail droppings as a control ranged from 6.8-7.4 ppm, not much different from the treatment that was given fertilizer in the form of quail droppings at different doses with dissolved oxygen values ranging from 6.2-7.8 ppm. According to Purba (2003), dissolved oxygen that is good for *D. magna* is more than 2 mg/L.

Ammonia in the maintenance medium was measured at the study's beginning, middle, and end. Ammonia in the rearing medium that was not treated as a control had a value of 0 mg/l, whereas, in the culture media that was treated with quail droppings as fertilizer, it had an ammonia value (NH_3/NH_4) ranging from 0-0.25 mg/L. The level of ammonia that can still be tolerated is at a concentration of 0.2 mg/L (Lavens & Sorgeloos, 1996). *D. magna* can still live and reproduce well at ammonia levels <0.2 ppm (Radini, 2004).

CONCLUSION

The results of the research conducted can be concluded:

1. Giving different quail droppings (Coturnix coturnix) affects the abundance of *Daphnia magna*
2. Provision of good quail droppings in this study, namely quail droppings at a 1-3 g/L dose.

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