

Growth Performance of *Daphnia* sp. Cultured in Different Concentration of Rice Washing Water

Lukman Anugrah Agung^{1,2*}, Muh. Herjayanto^{1,2}, Edo Ahmad Sholahudin¹, Rizky Muliani Dwi Ujjianti³

¹ Department of Fisheries, Faculty of Agricultural, University of Sultan Ageng Tirtayasa, Jl. Raya Jakarta Km 4, Pakupatan, Serang, Banten, Indonesia

² Aquaculture Laboratory, Department of Fisheries, Faculty of Agricultural, University of Sultan Ageng Tirtayasa, Jl. Raya Jakarta Km 4, Pakupatan, Serang, Banten, Indonesia

³ Department of Food Technology, Faculty of Engineering and Informatics, Universitas PGRI Semarang, Jl. Sidodadi Timur 24. Dr. Cipto Semarang, Indonesia

*lukman.anugrah@gmail.com

Abstract. This study aimed to investigate the effect of the administration of rice washing water in culture medium on the growth performance of *Daphnia* sp. This research using three different doses of rice washing water i.e 1 mL/L, 3mL/L, and 5 mL/L. *Daphnia* sp. was cultured with an initial density of 20 ind/L. Observed parameters include growth parameters (population density, size and specific growth rate) and water quality. This result showed that a concentration of 3 mL/L created the highest population of *Daphnia* sp. density about 620±20 ind/L, number small size (young stage) 81.2%, and the highest specific growth rate about 56.68±0.55%. The water quality content of DO, temperature and pH during this study were in the good range of *Daphnia* sp. life and reproduction. The research has a conclusion that rice washing water can be used to nutritional sources of *Daphnia* sp. In the future, it is necessary to make further observations about the reproductive performance of *Daphnia* sp, given rice washing water through clone culture.

Keywords: Live food, Population density, Rice washing water, Size of *Daphnia* sp., Specific growth rate

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1. Introduction

Aquaculture is the production of aquatic organisms and plants on controlled conditions [1]. Presently, Aquaculture is one of the promising agriculture activities that growing rapidly around the

world and has the potential to improve food security [2]. The success of aquaculture production depends on the all phase in aquaculture include broodstock holding, hatchery production of fry, nursing system, and grow out to market size [3]. Especially in fish larval farming on the hatchery, the obstacle is the availability and quality of live food at the right amount and size that suitable for the mouth size of the fish larva at the time of the first feeding.

Live food is used as a carrier of nutrition for the larval stage of aquatic animals [4]. *Daphnia* sp. is one of the potential live feeds that has been cultivated to meet the nutritional needs of freshwater fish hatcheries. The advantages of using *Daphnia* sp. for live feed in hatcheries due to its low cost and nutritional content [5]. The growth and development of *Daphnia* sp. are affected by nutrition, therefore alternative nutritional source that can increase the *Daphnia* sp. population is needed to maintain the availability of *Daphnia* sp. as live feed for the fish larvae. Rice washing water is one of the potential alternative nutritional sources for *Daphnia* sp. According to Laila [6], rice washing water is containing optimal nutrition to support the growth of *Daphnia* include Vitamin B1, Vitamin B3, Vitamin B6, Fe, natrium, phosphor, and kalium. This study aimed to investigate the effect of the administration of rice washing water on growth population, size, specific growth rate, and water quality of *Daphnia* sp.

2. Methods

2.1. Research on Weather Predictions

The rice washing water is obtained from the washing of rice with water at a ratio of 1:1 (w/v). After that, rice washing water were was allowed for 5 minutes [7].

2.2. Preparation of *Daphnia* sp.

Daphnia sp. used in this study were isolated from a fish pond in Serang Regency, Banten. The stock was cultured in an aquarium with a capacity of 25 L and feed with yeast *Saccharomyces cerevisiae* [8]. The individuals used in this study were adult stages that had a length of $2\text{ mm} \pm 0.4\text{ mm}$ and a width of $1 \pm 0.2\text{ mm}$.

2.3. Rearing of *Daphnia* sp.

This study was conducted at Aquaculture Laboratory, Department of Fisheries, Faculty of Agriculture, University of Sultan Ageng Tirtayasa. A total of 20 ind / L *Daphnia* sp. were reared using an aquarium with a size of $30\text{ cm} \times 30\text{ cm} \times 30\text{ cm}$ ($l \times w \times t$). Each aquarium is filled with 3 L of water an added aeration of 0.12 L/min. The study used three treatments of adding rice washing water in the culture media of *Daphnia* sp. (mL/L), i.e. 1 (treatment A), 3 (treatment B), and 5 (treatment C). Each tratment was repeated three times. *Daphnia* sp. culture is carried out for eighth days. The water (20-25%) of this culture was replaced every three days. Water quality, namely temperature, dissolved oxygen (DO), and pH, is measured every two days to maintain water quality. Temperature is measured using a thermometer ($^{\circ}\text{C}$), DO with the use of DO meter, and pH using pH meter.

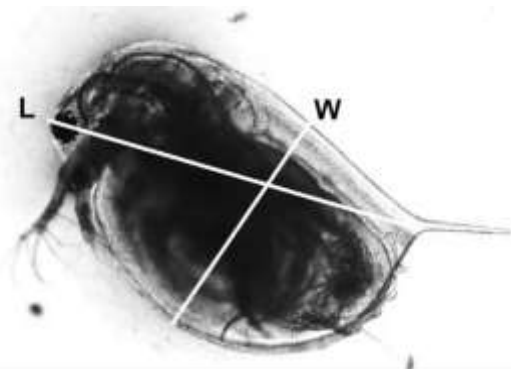


Figure 1. Character length (L) and width (W) in *Daphnia* sp.

2.4. Observation of *Daphnia* sp.

Observation for the abundance of *Daphnia* sp. was conducted every day to counting the population of *Daphnia* sp. The size of *Daphnia* sp. was observed on the last day of culture. Length and width measurements are performed using ImageJ software. Size is characterized into three groups namely, small (S), medium (M), and large (L), based on length and width (Figure 1). Size S has length 0.82-0.92 mm and width 0.46-0.55 mm, size M has length 0.93-2.14 mm and width 0.82-1.25 mm, and size L has length 2.15-3.19 mm and width 1.26-1.56 mm.

2.5. Data analysis

The population density and specific growth rate data were analyzed using Analysis of Variance (ANOVA) and for those with differences were subjected to Duncan Multiple Range test with a 95% confidence interval. The percentage of size *Daphnia* sp. and water quality were analyzed descriptively.

3. Results and Discussion

3.1. The population density and size of *Daphnia* sp.

The Effect of three different dosage addition of rice washing water on the population density of *Daphnia* sp. is presented in Figure 2.

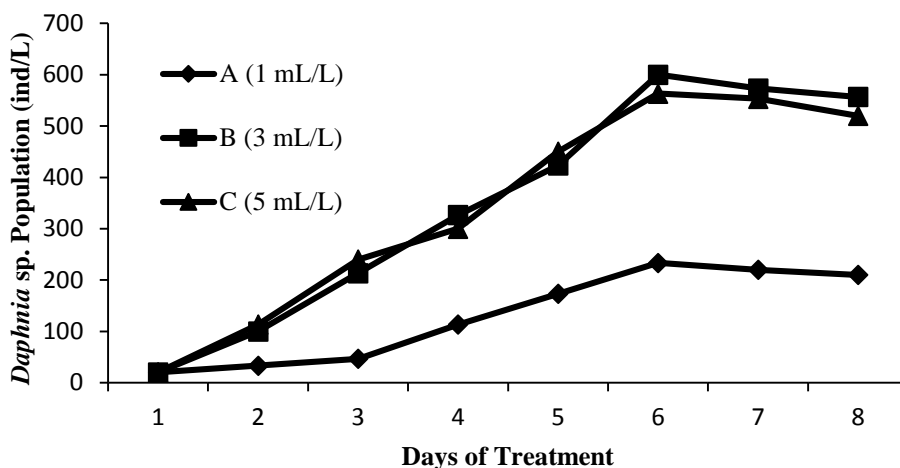


Figure 2. The Effect of three different rice washing water concentration on population density of *Daphnia* sp.

The densities of *Daphnia* sp. were cultivated on medium containing rice washing water with a concentration of 1, 3 and 5 ml/ L increased until the 6th day, then decreased on the 7th and 8th days. The highest peak density of *Daphnia* sp. given rice washing water was achieved on the 6th day. Similarly, the previous studies showed that that the peak growth density of *Daphnia* sp. occurred 6 days after the administration of tofu and bran fermentation [9]. Treatment B showed the highest density of *Daphnia* sp. which was 620±20 ind/L that was significantly different (P<0.05) from treatment A which was 180±50 ind/L and C was 580±15 ind/L. According to Lawrence [10], the growth and development of *Daphnia* sp. were affected by nutrient, age, temperature, and filtered particle shape. The result showed that *Daphnia* sp. can utilize nutrients from rice washing water so that it can increase the growth of the *Daphnia* sp. population.

Besides, the size of *Daphnia* sp. on the last culture day showed that all treatments produced more small size *Daphnia* sp (length 0.82-0.92 mm and width 0.46-0.55 mm). The number of small sizes or

young *Daphnia* sp. indicate that rice washing water supports reproduction of *Daphnia* sp. Treatment B produced the smallest size of 81.2% (Figure 3.). These results need to be observed further to observe the reproductive performance of *Daphnia* sp. given rice washing water through clone culture.

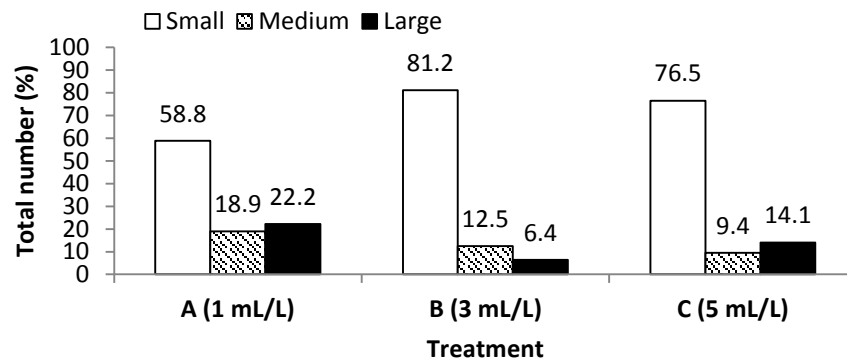


Figure 3. Percentage of the amount of *Daphnia* sp based on size on the eighth day of culture.

3.2. Specific growth rate

The Effect of the addition of three different dosages of rice washing water on specific growth rate of *Daphnia* sp. is presented in Figure 4. The result showed that the *Daphnia* sp. highest significant ($P < 0.05$) survival growth rate was found in treatment B which was $56.68 \pm 0.55\%$ followed by treatment C was $55.63 \pm 0.45\%$, while the lowest survival growth rate was found in treatment A was $40.67 \pm 3.74\%$. According to [11] *Daphnia* sp. requires adequate nutrition from food to reproduce and grow therefore resulting in a multiplied population increase that affect specific growth rate value. While in treatment A, the nutrition from rice washing water to *Daphnia* is insufficient, therefore showed a low specific growth rate.

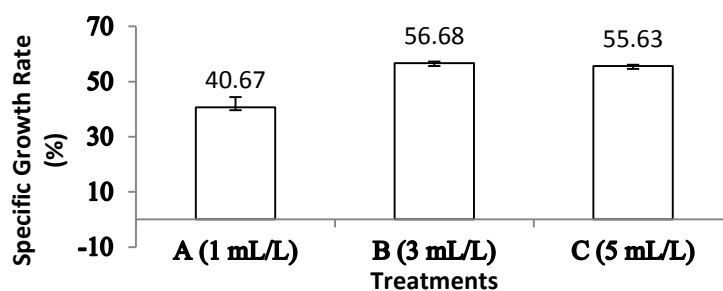


Figure 4. The Effect of three different rice washing water concentration on specific growth rate of *Daphnia* sp.

3.4. Water quality

Growth of *Daphnia* sp. influenced by water quality. In this study, water quality was maintained in the ideal range for *Daphnia* sp. The result of water quality showed in table 1.

Table 1. Water quality of rearing media with different concentration of rice washing water

Treatment	DO	Temperature	pH
A (1 mL/L)	7.45±0.08	27.57±0.07	7.58±0.04
B (3 mL/L)	7.47±0.31	27.61±0.02	7.62±0.07
C (5 mL/L)	7.6±0.00	27.63±0.06	7.61±0.11

The mean DO value in three different treatments in this study was 7.45±0.08 mg/L - 7.6±0.00 mg/L. According to [12], DO in culture media supports the respiration of *Daphnia* sp. without creating competition between *Daphnia* sp. and decomposing microbes. So, *Daphnia* sp. can utilize optimum DO for metabolism to growth and reproduction. *Daphnia* sp. can survive in DO >3 mg/L, but they grow better at a minimum of 6 mg/L.

The mean temperature value in this study was 27.57±0.07 °C - 27.63±0.06 °C. According to [13], the ideal temperature for the growth of daphnia was 25-30°C. In cladocerans, food activity depends on the temperature of the concentration of food. Therefore, better performance of reproductive and growth is expected from populations where there are nutritional conditions of abundance and appropriate temperatures [13].

The mean pH value in this study was 7.58±0.04 to 7.61±0.11. The ideal pH for the growth of *Daphnia* sp was 7-8.6 [1]. According to Darmawan [14], the pH affects the egg's life span of zooplankton microcrustaceans include *Daphnia*, and pH determines the toxicity of medium from ammonia. The ideal pH of *Daphnia* sp. was 7-8.6.

4. Conclusion

Rice washing water can be used as an alternative nutritional source for *Daphnia* sp. The addition of 3 mL/L rice washing water was the best concentration to the growing population, number of small size (young stage), and specific growth rate of *Daphnia* sp.

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