

Effect of Combination of Quail Dung and EM4 on Population Growth of Daphnia Magna

Hendra Kusuma and Mas Eriza

Department of Aquaculture, Faculty of Fisheries and Marine Science, Bung Hatta University



Abstract – This research discusses the effect of a combination of chicken manure and EM4 media on *Daphnia magna* population growth. *Daphnia magna* is a zooplankton organism that is often used in ecotoxicology and aquaculture research. Optimal cultivation media are essential for the growth and reproduction of *D. magna*. Chicken manure has been shown to increase *Daphnia magna* population density and growth rate. EM4 media, which consists of microorganisms, can help the decomposition process of organic materials and increase nutrient availability. In this study, four treatments were used, namely A (control), B (chicken manure 1.5 g/L + EM4 1 ml/L), C (chicken manure 2 g/L + EM4 1 ml/L), and D (chicken manure 3.5 g/L + EM4 1 ml/L). The results showed that the combination of chicken manure and EM4 media had a significant effect on *Daphnia magna* population growth. Treatment C (chicken manure 2 g/L + EM4 1 ml/L) gave the best results in terms of population density and growth rate. Chicken manure is also more effective than other chicken manure, such as chicken manure, cow manure, and goat manure, in increasing the growth and reproduction of *Daphnia magna*.

Keywords – Quail Dung; EM4; *Daphnia Magna*; Growth.

I. INTRODUCTION

Daphnia magna, or better known as water fleas, is a zooplankton organism that is often used in various ecotoxicology and aquaculture research. This organism has an important role in the aquatic food chain and is often used as an indicator of water quality because of its sensitivity to environmental changes. Therefore, understanding the factors that influence the growth and reproduction of *D. magna* is essential to support successful cultivation and other research applications. One of the factors that influence the growth and reproduction of *D. magna* is the culture media used. Previous research shows that suboptimal culture media can cause low reproduction, stunted growth, and high mortality rates in *D. magna*¹. Media containing complex trace elements, such as M4 medium, have been shown to support sustainable *D. magna* culture without signs of reduced viability or reproduction¹. Apart from culture media, nutritional sources also play an important role in the growth of *D. magna* populations. Research shows that using quail droppings as fertilizer can significantly increase the abundance of *D. magna*. In this study, variations in quail dung concentrations (1 g/L, 3 g/L, and 5 g/L) were tested, and the results showed that a concentration of 3 g/L produced the highest abundance². Apart from that, other research shows that quail droppings increase the growth rate of *Daphnia* spp. best compared to other organic fertilizers (chicken, cow and goat manure). Quail droppings have a higher total N content, namely 2.86%, and contain other nutrients such as 21% protein, 0.061% nitrogen, 0.209% P₂O₅, and 3.133% K₂O⁴. Organic materials through the decomposition process will grow more bacteria⁷, and these bacteria and organic materials are food for *Daphnia* spp.⁵. The availability of sufficient feed in the culture media will increase the growth rate of *Daphnia* spp. This shows the potential of quail droppings as an effective source of nutrition for cultivating *D. magna*. This research aims to explore the effect of a combination of quail dung and EM4 media on *Daphnia magna* population growth. EM4, or Effective Microorganisms 4, is a mixture of microorganisms often used in agriculture and aquaculture to improve soil and water quality. This combination is

expected to provide optimal conditions for the growth and reproduction of *D. magna*, so that it can support successful cultivation and further research applications.

II. METHODOLOGY

The research method used is an experimental method. Randomized Block Design (RAK) consisting of four treatments, namely A (Control), B (Quail Dung 1.5 g/L + EM4 1 ml/L), C (Quail Dung 2 g/L + EM4 1 ml/ L) and D (Quail Manure 3.5 g/L + EM4 1 ml/L) and three repetitions. The growth rate of *Daphnia maghna* was calculated using the equation according to Birch (1981):

$$\sum e^{7-rx} l_x m_x = 1097$$

Information:

e = natural logarithm

r = growth rate

x = maintenance time

lx = number of individuals living at time x

mx = number of offspring at time x

The research procedure has several stages, namely research preparation, formation of a *Daphnia* spp cohort. as well as primary research. Water quality is observed every 4 days during maintenance which includes temperature, DO and pH.

III. RESULT AND DISCUSSION

Based on the results, it can be seen that the combination of quail dung media and EM4 has a significant effect on the population growth rate of *Daphnia magna* (P<0.05). The research results of data on the density and growth rate of the *Daphnia magna* population are in table 1.

Table 1. Population Density and Growth Rate of *Daphnia magna*

Treatment	Density (Ind/L)	Growth Rate (ind/L/day)
A	2627.50±212.66 ^a	291.94±23.63 ^a
B	7435.00±378.06 ^b	826.11±42.01 ^b
C	9476.80±808.19 ^c	1052.98±89.80 ^c
D	6385.83±700.79 ^b	709.54±77.86 ^b

Based on Table 1, it can be seen that the combination of quail dung media and EM4 had a significant effect on the population density of *Daphnia magna* (P<0.05). The results of Duncan's further test analysis in Table 1 also show that treatment B is not significantly different from treatment D, while the other treatments are significantly different from each other. The highest population density of *Daphnia magna* was treatment C (9476.80±808.19 Ind/L) followed by treatments B (7435.00±378.06 Ind/L) and D (6385.83±700.79 Ind/L), while the lowest was treatment A (2627.50±212.66 Ind /L).

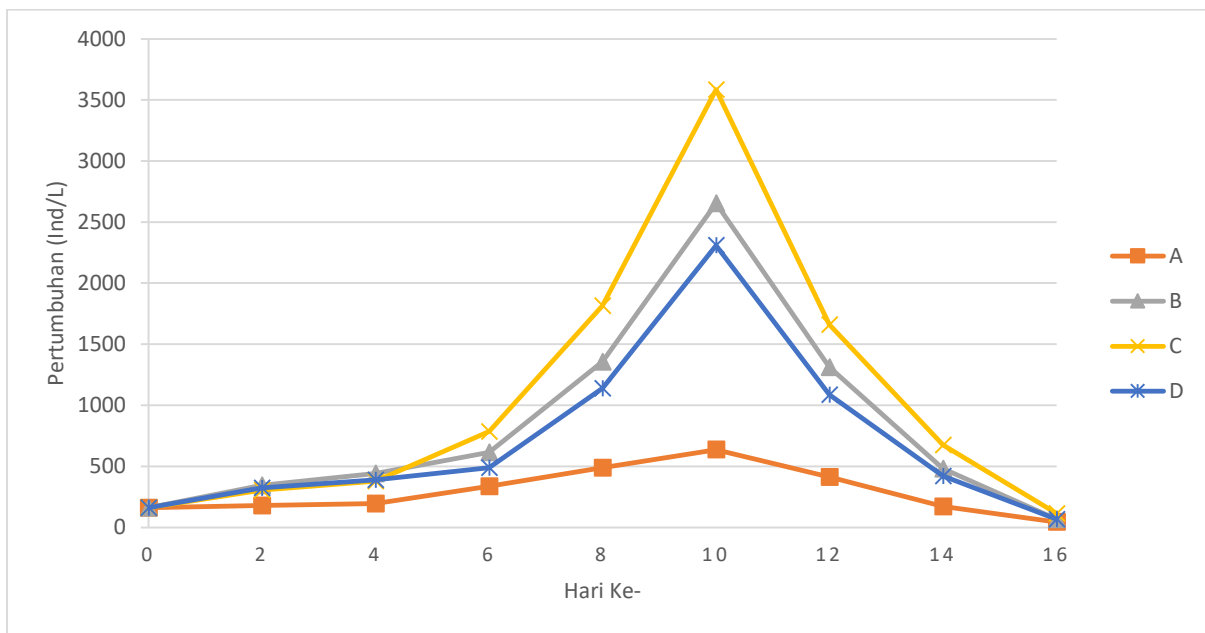
According to⁹, the high population density of *Daphnia* spp. when it reaches its peak, it shows that the population's growth rate is higher than its death rate. The growth and death rates of *Daphnia* are greatly influenced by the function of the feed. Feed for cultured *Daphnia* is nutrition added to the culture medium.

The combination of quail dung and EM4 media has proven effective in increasing the population growth of *Daphnia magna* by providing the necessary nutrients. Quail dung provides a rich source of nutrients, especially nitrogen, which is important for the growth of zooplankton and EM4 by helping accelerate the decomposition of organic matter, producing nutrients more readily. accessed by *Daphnia magna*^{2,8} and accelerates the decomposition of organic matter and increases the population of beneficial bacteria¹, these bacteria not only help in the decomposition of organic matter, but also function as direct food for *Daphnia magna*.

Based on Table 1, it can be seen that the combination of quail dung and EM4 media had a significant effect on the population growth rate of *Daphnia magna* ($P < 0.05$). The results of Duncan's further test analysis in Table 1 also show that treatment B is not significantly different from treatment D, while the other treatments are significantly different from each other. The highest population density of *Daphnia magna* was treatment C (1052.98 ± 89.80 Ind/L/day) followed by treatments B (826.11 ± 42.01 Ind/L/day) and D (709.54 ± 77.86 Ind/L/day), while the lowest was treatment A (291.94 ± 23.63 Ind/L/day).

The effect of a quail dung dose of 3 g/L can also provide the best growth for *Daphnia* sp., with a maximum density of 1725 ind/L compared to a dose of 0 g/L which only reached 475 ind/L^{2,8}. In another study the dose of 3 g quail dung /L also produced the highest abundance of *Daphnia magna*². Apart from the dosage factor, quail dung provides higher growth and reproduction rates compared to chicken, goat and cow dung¹. Quail dung also produces lower mortality rates compared to chicken, goat and cow dung¹. Increased growth and reproduction rates in the combination of quail dung and EM4 media supported higher levels of *Daphnia magna* compared to control media without quail dung or EM4.

The results of the high growth rate are caused by a fairly high organic material content in quail droppings including 21% protein, 0.061% nitrogen, 0.209% P₂O₅, and 3.133% K₂O content⁴ as well as N-total in quail droppings. namely 2.86%³, causing food reserves in the culture media to be abundant. The contents contained in quail droppings are utilized by *Daphnia* spp. as food and to grow bacteria from the decomposition process, the bacteria and suspended organic material are food for *Daphnia* spp.⁵



IV. CONCLUSION

The results of this study showed that the combination of quail dung and EM4 proved effective in increasing the growth and abundance of *Daphnia magna*. The optimal dose recommended is Quail Manure 1.5 g/L + EM4 1 ml/L, which gives the best results in terms of population density and other biological parameters. Quail dung is also superior to other types of dung such as chicken, goat and cow in terms of growth, reproduction and death rates of *Daphnia magna*.

REFERENCES

- [1]. Elendt, B., & Bias, W. (1990). Trace nutrient deficiency in *Daphnia magna* cultured in standard medium for toxicity testing. Effects of the optimization of culture conditions on life history parameters of *D. magna*. *Water Research*, 24, 1157-1167.
- [2]. Herawati, V., Nugroho, R., P., & Hutabarat, J. (2017). Nutritional value content, biomass production and growth performance of *Daphnia magna* cultured with different animal wastes resulted from probiotic bacteria fermentation. *IOP Conference Series: Earth and Environmental Science*, 55.
- [3]. Herman, H. Y., Andriani. A, Sahidin. T, Hidayat. And T, herawati. 2018. Culture of *Daphnia* sp. (crustacean-cladocera) : the effect of manure variation on the growth, natality, and mortality. *IOP Conf. Series : Earth and Enviromental science*. 137.
- [4]. Huri, E., dan Syafriadiman. 2007. Jenis dan Kelimpahan Zooplankton dengan Pemberian Dois Pupuk Kotoran Burung Puyuh yang Berbeda. *Jurnal Berkala Perikanan Terubuk*. 35 (1): 1-19.
- [5]. Jusadi, D., D. Sulasingkin., dan I. Mokoginta. 2005. Pengaruh Konsentrasi Ragi Yang Berbeda Terhadap Pertumbuhan Populasi *Daphnia* sp. *Jurnal Ilmu-ilmu Perairan dan Perikanan Indonesia*. Jilid. 12 (1) : 17-21.
- [6]. Jusadi, D., D. Sulasingkin., dan I. Mokoginta. 2005. Pengaruh Konsentrasi Ragi Yang Berbeda Terhadap Pertumbuhan Populasi *Daphnia* sp. *Jurnal Ilmu-ilmu Perairan dan Perikanan Indonesia*. Jilid. 12 (1) : 17-21.\
- [7]. Pennak, R.W. 1989. *Freshwater invertebrates of United States*. The Ronald Press company, New York. 580 pp.
- [8]. Santoso, M., Belagama, G., Nugrayani, D., & Pramono, T. (2023). CULTURE PRODUCTIVITY OF *Daphnia magna* FED WITH QUAIL DROPPINGS (*Coturnix coturnix*). *Journal of Fish Health*. <https://doi.org/10.29303/jfh.v3i1.2857>.
- [9]. Zahidah, W. Gunawan., dan U. Subhan. 2012. Pertumbuhan Populasi *Daphnia* spp. yang Diberikan Pupuk Limbah Budidaya Karamba Jaring Apung (KJA) Di Waduk Cirata Yang Telaah Difermentasi EM4. *Jurnal Akuatika*. Vol. III (1) :84-94.