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Application of different containers on eggs hatchability of saline tilapia fish (*Oreochromis Niloticus,* Linnaeus 1758)

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ABSTRACT

The community's need for saline tilapia seeds (*Oreochromis niloticus*) until now still shows a significant increase, the development of tilapia aquaculture business is growing from the sector of breeding and enlargement. This study aims to determine the level of hatchability of saline tilapia eggs (*Oreochromis niloticus*) with different containers to provide alternatives to the community in using saline tilapia egg hatching containers This research was conducted at the Laboratory of the Fish Seed and Feed Production Technology Study Program of the Polytechnic of Indonesia Venezuela (POLIVEN) in March-April 2024. The research method used was an experimental design, namely a non-factorial Completely Randomized Design (CRD) consisting of 4 treatments, namely A (using a gallon), B (using a teapot), C (using a chicken drinking funnel), D (using a flower pot) each carried out 5 times with test parameters including egg hatchability, larval abnormality, and water quality parameters. Based on the research that has been done, the highest degree of egg hatching is in treatment C (chicken dringking funnel) with a value of 92% an the lowest is in treatment D (flower pot) with a value 51%. The highest larva abnormality is in treatment B (teapot). The annova test result showed that the application of different containers on egg hatchability had a significant effect on the hatching of saline tilapia eggs (*Oreochromis niloticus*). Based on the results of Duncan's further test showed that the treatment of chicken drinking funnel with 92% percentage is the best treatment compared to other treatments.

Introduction

The province of Aceh has the potential for freshwater aquaculture. One of the freshwater fish that has economic value for farming is saline tilapia (Aziz *et al*., 2021). The public demand for saline tilapia (*Oreochromis niloticus*) seeds still shows a significant increase. This is influenced by the increasing development of fish farms and the opening of new land for saline tilapia farming. Both sectors are very promising markets for farmers involved in saline tilapia (*Oreochromis niloticus*) hatcheries.

The KKP Statistical Data Centre reported that the total production of tilapia in Indonesia was 464,191.15 tons in 2010 and is expected to increase further to 1,356,654.06 tons in 2022 (KKP Statistics, 2020). However, until now, the Fisheries Data Centre has not recorded statistical data on the annual production of Saline tilapia Seeds.

Tilapia hatchery activities are common in several regions of Indonesia. Therefore, tilapia strains are well known to the Indonesian people for both consumption and business development. Tilapia (*Oreochromis niloticus*) is a type of consumable fish that is easy to cultivate and is in high demand by the public Wibowo *et al.* (2021). Tilapia is easy to adapt to new environments, has a high survival rate, is easy to breed and its growth rate is fast Angriani *et al.* (2020).

One of Indonesia's leading commodities, salted tilapia (Oreochromis niloticus), has the potential to be improved to enhance human welfare, national food security and economic resilience (Sustiawan *et al.,* 2024). The saline tilapia commodity was chosen

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as an alternative to cultivation in brackish or marine media to meet the needs of domestic consumption and for export purposes (Aziz *et al*., 2021). Saline tilapia is the third most successful aquaculture species after shrimp and salmon (Samsu, 2020).

Explains that to support tilapia farming on a mass scale, the availability of seeds is one of the important variables. To meet the needs of tilapia seeds in large quantities and continuously, it is necessary to make efforts to seed them so that the availability of seeds can be guaranteed properly and sustainably (Sumarni, 2018). Fulfillment of the needs of saline tilapia seeds until now still relies on seeds from hatcheries in freshwater (Soleh *et al.,* 2020). As a result, the community has difficulty in obtaining saline tilapia seeds that are ready to be applied directly to the pond.

The problem that remains an obstacle in the process of saline tilapia hatcheries is the frequent failure of the hatching stage due to improper handling of the eggs. Hatchability is a very important factor in the seed production process. High hatchability can produce many larvae so that the seed supply and production process runs well (Pahmi *et al.,* 2024). Basically, intensive hatching of fish eggs can be done in hatching tanks, aquariums and buckets. However, the eggs cannot hatch perfectly due to the low stirring of the water mass. As a result, the concept of tilapia egg hatching has changed to the use of a funnel system.

Hatching eggs in a funnel can increase the hatchability of tilapia eggs, but on the other hand this method requires high production costs. The hatchery is designed for natural egg hatching. This is reflected in the environmental conditions, water supply for egg movement, dissolved oxygen, etc (Pahmi *et al.,* 2024).

Based on the above problems, there is a need to further investigate the research entitled "Different container applications on the hatchability of saline tilapia (*Oreochromis niloticus*) eggs". The objective of this study was to determine the best egg hatching rate using different hatching containers. The benefit of this research is to provide an alternative to the hatchery community in using the right container for hatching tilapia eggs.

Materials and Methods

Location and time of research

This research was carried out in the Fish Hatchery Laboratory of Fish Seed and Feed Production Technology at the Polytechnic of Indonesia-Venezuela from March to April 2024.

Methods and Material

The tools and materials used in this study are listed in Table 1.

Tabel 1. Tools and Materials

Tools and materials	Unit	Function
Gallon containers,	5 Unit	Egg Hatching Container
Chicken drinking funnel containers,	5 Unit	Egg Hatching Container
Flowerpots	5 Unit	Egg Hatching Container
Teapot Containers,	5 Unit	Egg Hatching Container
larval shelters,	1 Unit	Larval counting station
Water Pump,	2 Unit	circulating running water
Water quality tools	1 Unit	To measure water quality
Camera,	1 Unit	Documentation of Activities
Strainer,	2 Unit	For filtering Fish
Basin,	4 Unit	Number of hatchery larvae
Bucket,	4 Unit	To accommodate larvae
Microscope,	1 Unit	Melihat Perkembangan Telur
Stationery.	1 Unit	As a research note
Salted tilapia eggs,	200 eggs	Research Materials

The method used in this study was a non-factorial Completely Randomized Design (CRD) using 4 treatments Each treatment was carried out 5 times so as to obtain 20 experimental units.

A = Treatment using gallons
B = Treatment using a teapot
C = Treatment using chicken drinking funnel
D = Treatment using pots flowers

Preparation of Research Containers

The preparation of containers for hatching saline tilapia eggs involves purchasing tools and materials, cleaning, sterilizing and installing them in the system. Containers are washed with detergent, rinsed with water and then dried in the sun. Next, the containers are modified as required and installed on the hatching rack, then the container is connected to a water pump to circulate or move water from each container and the container is ready for use.

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Picture 1. Gallon Containers

Picture 2. Tea Pot

Picture 3. Chicken Drinking Funnel

Picture 4. Flower pots

Test Organism Preparation

This study used saline tilapia eggs obtained from the Brackish Water Aquaculture Fisheries Center (BPBAP) Ujung Batee, Aceh Besar District as test samples. Before being placed in the test tanks, the fish eggs were first counted according to the test treatment using chicken feathers, cutting boards and sieves (Figure 1,2,3,4). Each test tank is filled with 200 eggs, and observations are made every four hours to determine the development of the test eggs.

Water Quality Measurement

Water quality parameters were measured directly in each hatchery container and saline tilapia larvae shelter in the morning and evening. The parameters observed included temperature, total dissolved solids (TDS) and acidity (pH) and the values obtained were recorded in the form of daily notes. The tools used are thermometer, TDS pent and pH pent.

Research Parameters

Hatching Rate (HR)

Hatching Rate is the level of the egg's ability to develop at the time of the embryogenesis process until hatching (Marsela *et al*., 2018). Calculation of the degree of hatching is done after the eggs hatch and first separate the eggs that hatch and the eggs that do not hatch (Aziz, *et al*., 2021). Sample calculations were carried out using the formula (Hui *et al*., 2014).

$$HR\ (\%) = \frac{Jtm}{Jtb}\ x\ 100\%$$

Description:
HR : degree of hatching (%)
JTM : number of eggs hatched
JTB : number of fertilized eggs

Water Discharge in Test Container

$$D = \frac{V}{T}$$

Description:
D : Discharge
V : Volume
T : Time

Data analysis

The hatchability and survival data obtained are tabulated and analysed using a processing software program that includes ANOVA analysis of variance. If there is a significant effect, Duncan's post hoc test with 95% confidence will be used to determine differences between treatments, while daily water quality data will be analysed descriptively.

Results and Discussion

Hatching Rate (HR)

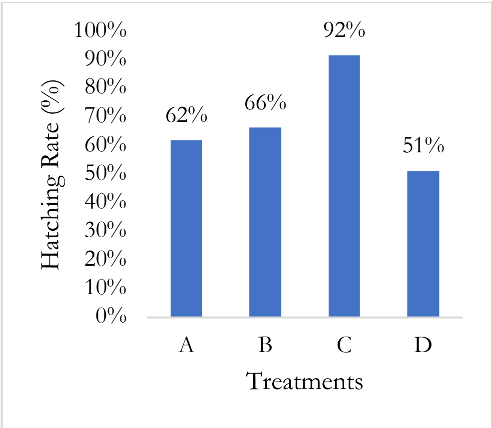

Figure 5. Hatching Rate

The results of observations during the study showed that the level of hatchability of the saline tilapia ranged from 51% - 91%. based on Figure 5 high hatchability in treatment C (chicken drinking funnel) with a value of 92% due to the water in the media is stirred actively and continuously. this is closely related to the design of the bottom of the container that buds down. Hatching using the funnel system resulted in higher hatch rates (Pandit *et al*., 2017) due to the constant movement of water and eggs, similar to the movement of eggs in the mouth of the mother fish (Mellisa *et al*., 2022).

Low hatchability in treatment D (flower pot) with a value of 51% due to incomplete stirring of the water, which can be seen at the bottom of the container where many eggs are not stirred, causing them to accumulate and settle on the edge of the container bottom, eventually becoming Mildewed. The effect of the lack of water movement, so that the circulation also has an effect on the durability of the eggs to hatch. this lack of water movement causes the eggs to expand rapidly, becoming damaged and mildewed (Adipu *et al.,* 2024).

The results of analysis of variance (ANOVA) showed that the application of different containers on the hatchability of saline tilapia (*Oreochromis niloticus*) had a significant effect on the hatching of saline tilapia eggs. The results of Duncan's further test showed that the level of hatchability of saline tilapia in treatment C was significantly different from treatment A, B, and D.

The treatments applied in this study show that the hatching process of the saline tilapia passes through all the stages perfectly, but the percentage of hatching obtained is different from each treatment (Table 2). This is thought to be due to the influence of the shape of the container used. In addition to the different container shapes, the application uses a water circulation system that also keeps the eggs in motion so that the embryos are actively moving and stimulating the hatching process.

Tabel 2. Duncan's further test results table

Treatment	Mean
A	3,00±1,581 [ab]
B	3,00 ±1,581[ab]
C	2,80±1,304 [b]
D	3,00±1,581[a]

This is supported by the statement of Redha *et al*., (2014), incubation techniques are a combination of mechanical work and enzymatic work causing fish eggs to hatch. According to Mellisa *et al.,* (2022), applying a water circulation system with different containers and the results obtained that the chicken drinking funnel system is more effective for water circulation than the conventional system and that temperature has a significant effect on the time and speed of hatching, yolk absorption time, and larval abnormalities.

Abnormality

In the process of hatching saline tilapia eggs (*Oreochormis niloticus*) eggs that have been counted in each test container will be controlled every 4 hours, and will be viewed under a microscope at 12 hours. The eggs will begin to see the development of the head and also the tail at 24 hours after incubation. unhatched eggs appear to have no movement or signs that the eggs can still hatch. Unhatched eggs will look solid black when viewed under a microscope and look milky white to the naked eye. At 48 hours the larvae start actively swimming to adapt, and at 72 hours the larvae start looking for food (Figure 6).

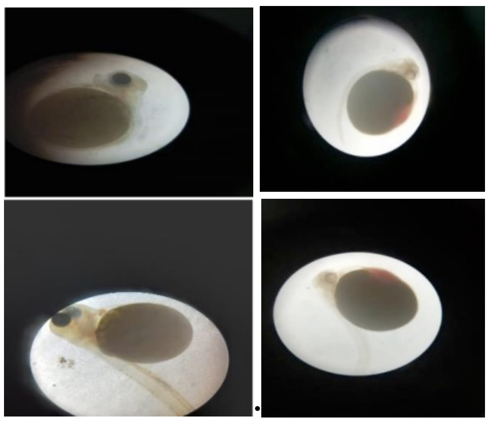

Figure 6. Imperfect embryogenesis (Personal Documentation)

Based on laboratory tests, fish abnormalities can be observed in the shape of the head, body, or tail

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that is bent, a body that is shrunken or shorter than normal size, and differences in behavior in fish larvae. Imperfect embryogenesis appears 24 hours after hatching. Imperfect larvae die sooner because they move less. 24 hours after hatching, the yolk is still visible, making contamination easier.

abnormalities in the larval phase can also occur in gill open gills, mouth defects (short upper mouth and/or short lower mouth), and a twisted spine, including: iordosis (body curved upwards), kyposis (body curved downwards), and skiolysis (body shortened due to spine curved upwards and downwards). Abnormal larvae are indicated by their smaller body size (premature), and may not live long after 12 hours from hatching (Effendi *et al.,* 2015; Lestari *et al.*, 2024). Sumarmin (2016) states that the characteristics of abnormal larvae are seen in the shape of a twisted body and abnormalities in the shape of the head and tail that are bent and bent on the backbone, so that the larvae will die when the yolk has run out because they cannot actively move. Abnormal larvae will survive for 2 or 3 days but will die during rearing.

Abnormality is thought to be caused by the diameter of the test container in the treatment so that it inhibits the movement of embryos when hatching and may be a lack of male sperm that can inhibit embryos when hatching. In addition, it is caused by temperatures that are too high so that the eggs cannot hatch perfectly and ultimately result in growth, as well as genetic factors that also affect the hatching (Firdaus *et al*, 2021).

Water Quality

Another factor that affects the hatchability of saline tilapia eggs is water quality. Good water quality can help the process of cell division and egg development until hatching (Sutisna and Sutarmanto, 2006). The results of the range of physical parameters of water chemistry as follows:

Table 3. Water Quality Range During the Study

Parameters	Average Value
Temperature	27,8°C
Dissolved Solids (TDS)	360.12 mg/l
Degree of Acidity (pH)	8,289

Based on the Table 3, it can be seen that the value of physics-chemistry parameters of media water during the study can still be tolerated by saline tilapia in the egg hatching process. Fertilized eggs hatched in different media have a minimum dissolved solid content of 360 mg/l, pH 7-8, and water temperature 27-28°C. According to Mulyadi *et al.,* (2014), factors that affect the high and low survival are abiotic and biotic factors including water quality, competitors, density, population, age and the ability of organisms to adapt to the environment. Abiotic factors include food availability and living media environment (Supardan *et al.*, 2022).

The results of temperature measurements in each treatment showed that the average temperature value obtained was 27.8°C. This shows that the normal temperature of water in a container with a circulation system affects the development of embryos in the hatching process. According to Junita (2017), a good temperature for fish hatching ranges from 27-30°C and water temperature has an impact on the life of aquatic biota including fish, temperature affects the metabolic rate and oxygen consumption of aquatic organisms.

Temperature plays a very important role in the hatching process because it is related to metabolic activity and embryos. According to Rahmadi *et al.,* (2021), at low temperatures the metabolism runs very slowly so that the embryo also slows down, on the other hand at high temperatures the hatching process will occur faster because metabolism increases and can cause abnormal cell or larval death, but excessive temperatures also cause activity and the embryo is disturbed which causes no hatching of the egg. Andriyanto *et al.,* (2013), extreme temperatures can cause death to the embryo and hatching failure. Pratama *et a.,* (2018), the role of enzymes also affects the hatching process, excessive temperature increases can cause denaturation and enzyme work activity to be disrupted, causing enzyme concentration and speed to decrease as well as when the enzyme is at too low a temperature.

The results of TDS measurements in each treatment showed that the average value obtained was 360.12 mg/l. This shows that the total dissolved solids (TDS) is still quite normal in the hatching of saline tilapia eggs. Total Dissolved Solids (TDS) ranges from 330-744 ppm. Although large amounts of TDS can cause water turbidity, TDS data are still in normal conditions which are less than 1000 ppm.

Water Discharge

Based on the results of measuring water discharge, it is still fairly normal that each water container is able to release 1 liter in 28 seconds with a water discharge of 0.035 liters / second. the water discharge in the hatching funnel is 0.8 liters/second. Because the water discharge is too small, it can cause the eggs not to be stirred and can accumulate, causing the eggs not to hatch. Water discharge that is too small can result in eggs not moving and lack of oxygen. Eggs that do not move and lack oxygen will die (Aziz *et al*., 2021).

Conclusion

Based on the results and discussion of the research conducted, it can be concluded that the application of different containers has a significant effect on the hatchability of saline tilapia eggs, from the best results, namely the chicken drinking funnel is suitable for use as a hatching saline tilapia egg (*Oreochromis niloticus*). While the measurement of physical parameters of water chemistry showed good results in the incubation process of saline tilapia egg hatching.

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