Advances in Tropical Biodiversity and Environmental Sciences
9(1): 62-66, February 2025
e-ISSN:2622-0628
DOI: 10.24843/ATBES.2025.v09.i01.p10
Available online at: https://ejournal1.unud.ac.id/index.php/atbes/article/view/1016

Dry Transportation Of Sea Bass Using Clove Oil

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Abstract. White sea bass (Lates calcarifer) is a valuable fishery commodity that holds a significant market share, including as an export product. The high demand for white sea bass necessitates its seamless transportation. However, most fish experience stress to the point of death during transportation, and accommodations are expensive. Therefore, dry system transportation is a method that has the potential to be applied to reduce fish stress and lower transportation costs. This research was conducted using a completely randomized design (CRD) with three treatments and three replications, utilizing white snapper seeds measuring 5-6 cm. The treatments tested had different densities, specifically treatment A with 10 individuals, treatment B with 15 individuals, and treatment C with 20 individuals. Fish transportation was carried out with previous fish anesthesia, using commercial clove oil as an anesthetic at a dose of 0.10 ml/L of seawater. Based on observations of transportation during the 1-hour journey, treatment C with a density of 20 animals was the best, namely with an inductive time of 4 minutes, a stun time of 1 hour, and a sedative time of 18 minutes, resulting in a post-transportation survival rate of 78% and a post-rearing survival rate of 76%. The use of clove oil was effective in maintaining the survival rate of white snapper (Lates calcarifer) seeds after dry transportation and throughout the research period.

Keywords: clove oil, density, dry system transportation, white sea bass

I. INTRODUCTION

One of the fishery commodities with high economic value and a wide market share is the white snapper (*Lates calcarifer*). KKP (2012) reported that the annual exports of white snapper to Hong Kong and Singapore ranged from 60 to 250 tons. White snapper is a primary commodity for aquaculture, with market opportunities driven by its relatively good environmental adaptability and its relatively fast growth rate [2].

In carrying out cultivation activities, transportation is an essential aspect in supporting the success of fisheries cultivation. The availability of seeds is not fulfilled, so it is necessary to import them from outside the area using transportation. The transportation process must consider the health condition of the fish during and after transportation, as well as the transportation capacity. One potential transportation method to be implemented is dry system transportation, or without water media. Dry transportation has the advantage of saving costs, reducing fish stress, and increasing the number of transportations.

When carrying out dry transportation, it is necessary to stun the fish with an anesthetic agent to inhibit their metabolic activity [9]. Stunning or anesthetizing the fish can support their survival until they reach their destination and increase the number of transports [8]. Providing anesthetics to stun fish is crucial in reducing the physiological response to fish stress, promoting calmness and comfort, and preventing physical injury [3]. The anesthetic used to stun fish is a natural substance that is safe for both fish and humans, as well as the environment. Clove oil (*Eugenia aromatica)* is a natural ingredient that can be used as an anesthetic because it contains 70–80% eugenol. At a concentration of 10 – 20 ppm, clove oil can be used as an anesthetic for fish [7]. For this reason, research on the growth and survival of white sea bass (*Lates calcarifer*) seeds after dry transportation with different densities using clove oil (*Eugenia aromatica)* is needed.

II. METHODS

A. Research Location

This research was conducted at the Coastal Fish Seed Center in Tablolong for 30 days.

B. Tools and Materials

The tools and materials used in this research were a 5 ml scale pipette, measuring cup, small bucket, spoon, small sieve, styrofoam, filter cotton, duct tape, stopwatch, stationery, cellphone, tub, aerator, aeration stone, and hose, and fish seeds: white snapper, clove oil, sea water, ice cubes, and pelleted feed.

C. Research Procedure

The test fish used were 135 white snapper seeds measuring 5-6 cm. The clove oil used was commercial clove oil. The styrofoam used as a transportation medium measures 22 cm × 35 cm × 13 cm. This study employed a completely randomized design (CRD) with three treatments and three replications. The density treatments carried out were A, with a density of 10 individuals; B, with a density of 15 individuals; and C, with a density of 20 individuals.

The research was preceded by a test dose of clove oil, with the tested doses being 0.05 mL, 10 mL, and 0.15 mL. Each test dose of clove oil was dissolved in a container containing 1 liter of seawater. Induction time, fainting time, and sedative time are observed to get the best dose. Next, the best dose will be used as a dry transport anesthetic agent with different densities.

Dry transportation is carried out under previous anesthesia, namely by soaking the fish in a container containing a clove oil solution. Fish that have entered the fainting phase are lifted and arranged in styrofoam with varying densities, which have been lined with filter cotton and given a small amount of water until they become stagnant. Fish that have been neatly arranged are covered with skinny filter cotton to limit the movement of the fish due to shocks during travel, but the cotton does not interfere with the movement of the fish's gills. Next, the styrofoam is closed and taped, and ready to be transported for 1 hour.

D. Parameters Observed

a. Main Parameters

1. Long inductive time

   The inductive time of the test fish is calculated based on the time the fish is placed in the solution until the fish enters the unconscious phase (immotilization). Inductive time is calculated in minutes and seconds.

2. Long time of fainting

   The duration of unconsciousness was calculated from the time the test fish was transported until it regained consciousness.

3. Long duration of sedative

   The calculation of the sedative time (conscious time) for test fish is performed once the fish has finished being transported and is placed in water media with vigorous aeration, until the fish exhibits movement. The calculation of sedative time is expressed in minutes and seconds.

4. Survival Rate

   The calculation of the survival rate of white snapper seeds was conducted during the anesthesia process and post-transportation.

$$SR = \frac{Number\ of\ live\ fish}{Initial\ stocking\ amount}\ x\ 100\%$$

b. Parameters During Post-Transportation Maintenance

1. Fish survival rate during post-transportation maintenance. The survival rate of white snapper seeds is determined after 14 days of rearing:

$$SR = \frac{Number\ of\ live\ fish}{Initial\ stocking\ amount}\ x\ 100\%$$

2. Post-transportation growth of white snapper seeds. The growth of white snapper seeds is calculated as follows: W = Wt – Wo.

E. Data Analysis

The data obtained from the research results are in the form of data on the length of inductive time, the time to faint, the sedative time, data on fish survival after transportation and fish survival after the rearing period, as well as absolute growth data which is analyzed using analysis of variance (ANOVA) if it has a significant effect then will be continued with the Least Significant Difference (BNT) test.

III. RESULTS AND DISCUSSION

A. Test the Best Dose of Clove Oil as an Anesthetic

The doses of clove oil (*Eugenia aromatic*) tested to determine the optimal dose were 0.05 mL, 0.1 mL, and 0.15 mL, with the results of the inductive time observations shown in Figure 1. The inductive time indicated by different clove oil doses based on the ANOVA test showed that the clove oil dose treatment had a significant effect on calculated F (42.39) > from the F

table 5% (0.00) on the inductive time, so a further BNT test was carried out. Additional test data obtained showed that treatments A, B, and C were significantly different from each other. The average inductive time for each treatment dose is as follows: treatment A (0.05 ml) has an inductive time of 6 minutes, treatment B (0.10 ml) has an inductive time of 3 minutes and 67 seconds, and treatment C (0.15 ml) has an inductive time of 1 minute and 22 seconds. The higher the dose of clove oil, the faster the inductive time. The higher the concentration of a test substance, the faster the concentration of the compound is absorbed by the body, so that the fish will enter the fainting phase more quickly [1].

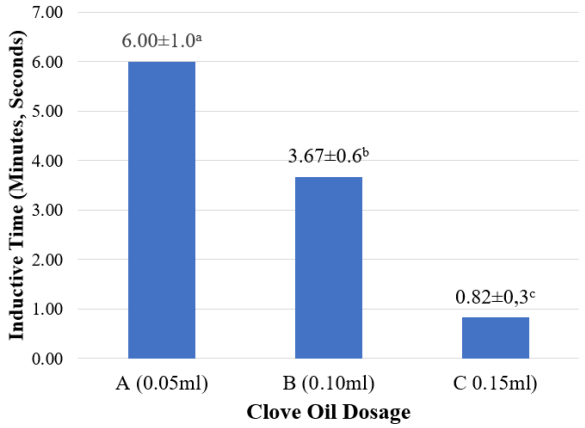

Figure1. Inductive time bar diagram of clove oil dosage.

The length of time the test fish fainted in the transport medium, based on different doses of clove oil, is shown in Figure 2.

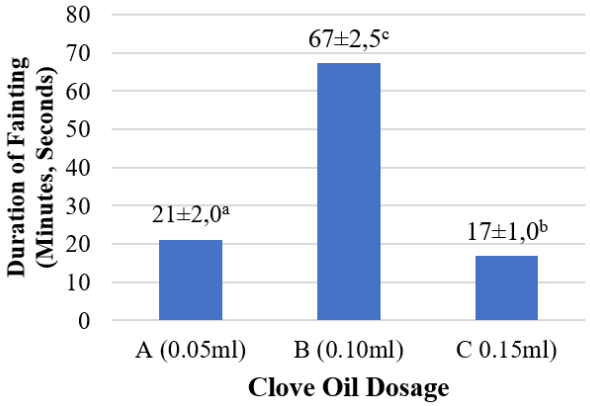

Figure 2. Bar diagram of the duration of exposure to clove oil doses.

The results of observing the duration of fainting for white snapper fry were tested by ANOVA, which showed that the clove oil dose treatment had a real influence on calculated F (621.56) > from F table 5% (0.00) on the duration of fainting, so a further BNT test was carried out. Additional test data showed that treatments A, B, and C were significantly different from each other, with the longest time to faint in treatment B. Inappropriate concentration doses of anesthetics resulted in the fish having difficulty adapting to stress and even death, because the fish's body was unable to maintain it's a homeostatic state.

The results of observations on the sedation time of white snapper seeds after stunning are shown in Figure 3.

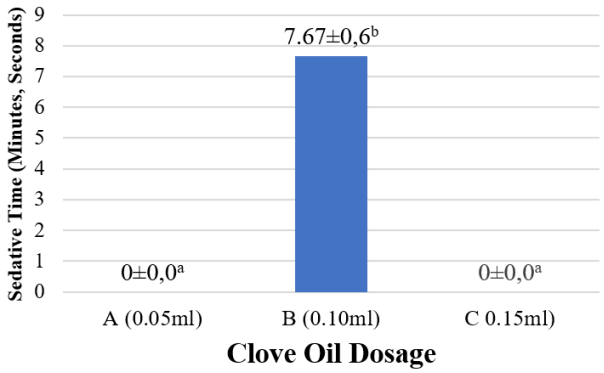

Figure 3. Time bar diagram of sedative clove oil dosage.

The results of the observations on sedation time for sea bream seeds were analyzed using ANOVA, which showed that the clove oil dose treatment had a significant effect on sedative time, as calculated F(529.00) > F table 5% (0.00). Therefore, a further BNT test was carried out. Additional test data obtained showed that treatments A and C were significantly different from treatment B, while treatments A and C were not significantly different from each other. The sedative time for treatments A and C was zero because the test fish died in the transport medium before it could be revived. Meanwhile, the sedative time for treatment B was 8 minutes and 7 seconds. A compound can be considered a good anesthetic at a specific concentration if it has a significant influence on the central nervous system, causing the individual to lose consciousness in a particular period, and is easily decomposed, allowing the individual to regain consciousness [4].

Based on the results of observations and ANOVA tests on different doses of clove oil, the optimal dose was found in treatment B, specifically 0.10 ml of clove oil dissolved in 1 liter of seawater. Furthermore, this dose is considered the optimal dose for the dry transportation of white snapper seeds with varying densities.

B. Survival Rate of White Snapper Post-Transportation

Dry transportation of white snapper seeds with varying densities was conducted during a 1-hour journey, utilizing the optimal dose of clove oil from the trial results, specifically 0.10 ml. The fish are stunned by immersion, and then the unconscious fish are placed in a transportation medium. The fish were transported for 1 1-hour journey, then revived, and their survival rate was observed. The survival of white snapper seeds is evident in Figure 4.

The survival rate of white snapper seeds after 1-hour transportation was tested using ANOVA, with the results showing that the different density treatments in dry transportation of white snapper seeds had no significant effect on the post-transportation survival rate, as calculated F (0.21) < F table 5% (0.979). The impact of total density on post-transportation survival rates was not significantly different; therefore, it can be stated that the effective density treatment was treatment C, with a density of 20 individuals. Treatment C resulted in a post-transport survival rate of 78.33% which is more effective than treatments A and B.

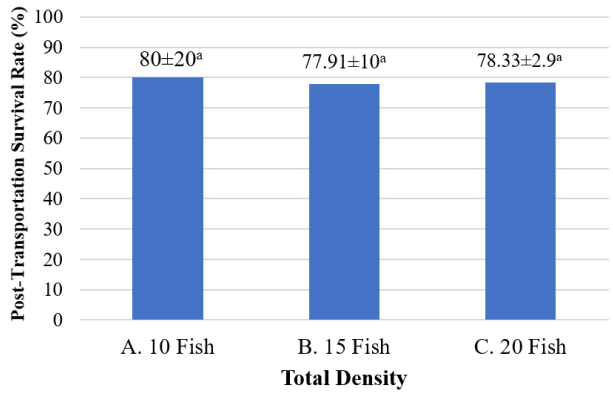

Figure 4. Post-transport survival rate.

C. Survival Rate of White Sea Bass at the End of Rearing

Post-transportation white snapper seeds are then kept for 14 days, with the number of stockings based on the survival rate of each treatment, to obtain real data regarding survival. Data on the survival of white snapper seeds after transportation are shown in Figure 5.

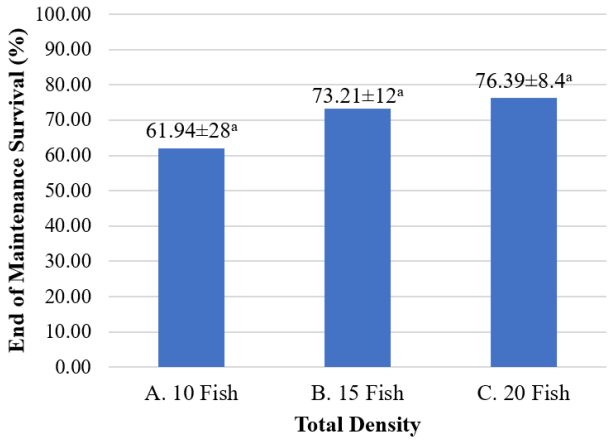

Figure 5. Final survival rate of the study.

The results of the ANOVA test showed that different density treatments had no significant effect on the survival rate of sea bass fry at the end of rearing, with F count (0.504) < F table 5% (0.627). The effect of total density on survival rates at the end of rearing was not significantly different; therefore, it can be stated that the effective density treatment was treatment C, with a density of 20 individuals. Treatment C resulted in a final survival rate of 76.39% which is more effective than treatments A and B.

Magnifying the results of observations, white snapper fry experienced death or mortality on the first and second days after transportation. This was because the fish had not completely released the anesthetic substance in their bodies, which also affected their condition. Anesthetic substances are not entirely lost from the fish's body because the osmoregulation process is not working correctly [5].

D. Growth of White Sea Bass Seeds Post-Transportation

The absolute weight growth of white snapper seeds reared for 14 post-rearing periods was carried out in the ANOVA test, with the results shown in Figure 6.

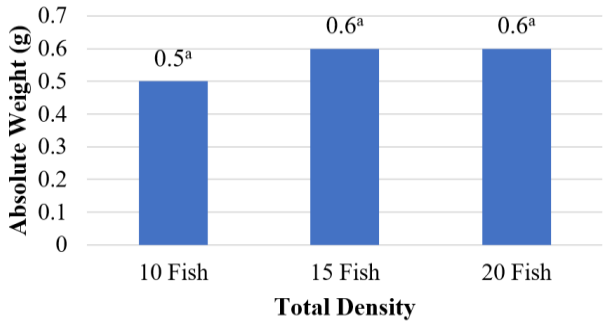

Fig.6. Growth of white snapper seeds

The results of the ANOVA test carried out showed that the dry transportation density of white sea bass seeds had no significant effect on absolute weight, after 14 days of rearing, so that treatment C was an effective treatment compared to treatments A and B.

The increase in the rate of feed consumption, which can be seen from the absolute weight gain, indicates that the condition of the white snapper fry has recovered. Stressed fish will reduce their appetite, as under stressful conditions, their blood glucose levels increase [11]. Meanwhile, the white snapper fry have recovered to the point where the feed consumed is fully utilized for growth.

IV. CONCLUSION

The optimal dose of clove oil as an anesthetic for the dry transportation of white snapper seeds is 0.10 ml/L seawater. Meanwhile, the best density for dry transportation of white snapper seeds was in treatment C, 20 fish/0.0016 m3, with the survival rate (SR) of white snapper seeds after transportation is 78%, the survival rate (SR) of white snapper seeds at the end of rearing is 76 %, and absolute weight gain of 0.6 g after 14 days of maintenance.

ACKNOWLEDGMENT

The author would like to thank the Head of the Tablolong Coastal Fish Seed Center (BBIP), who has guided and provided facilities in conducting research.

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