Survival Rate Evaluation of Different Filler Medium of Waterless Live Fish Transportation of African Catfish *(Clarias* sp.) Broodstock

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Abstract

The supplying of live fish broodstock is routinely delivered by water. However, the traditional transportation of live fish with water results in small volume of transportation. Therefore, waterless transportation with different filler medium of waterless live fish transport is considered an alternative strategy. This research aimed to evaluate the effect of different filler medium of waterless live fish transportation on survival rate of African catfish (Clarias sp.) broodstocks. Brooders with mean weight 116 ±10,25 g were packed at 5 fish/bag for simulated 15h transportation. The bags, each 40x25x15 cm^3, were filled with different treatment of medium; Sponge, newspaper, cloth, and sawdust at 3 cm thickness of sponge medium and ½ kg for newspaper, cloth and sawdust medium per bag. One bag without medium was designed as a control. Mortality, temperature, Humidity and weight gain loss were monitored throughout the experiment. After simulation, mortality, pH, DO and temperature were monitored in fiber pond over 14 days. Effect of different treatment of medium was significantly different ($p < 0.05$) with highest survival (100%) at sponge and cloth medium, and lowest survival (24 %) at sawdust medium. Humidity of newspaper medium and weight gain loss of sawdust medium significantly decreased and no significantly different in temperature parameter after simulated 15h transportation. It was concluded that sponge and cloth medium might be applied as a filler medium for waterless live fish transportation.

Keywords: Clarias sp., broodstock, filler medium, waterless transportation, survival rate.

1. Introduction

African catfish *(Clarias* sp.) is one of the most important of farmed fish. African catfish has tolerance to a wide range of environmental conditions such as pH, temperature, nitrogen wastes, low dissolved oxygen concentration and handling easiness has led to the expansion of farming (Richter and Rustidja, 1985; Rustidja, 1999)Khairuman dan Khairul, 2002; Rukmana; 2003; Fujaya, 2004; Suyanto, 2007; Kusyairi *et al.*, 2013). Increasing of African catfish farming production needs appropriate methods to distribute broodstocks or fingerlings from hatcheries to wild, farm ponds or other hatcheries that can reduce the mortality and stress due to broodstocks or fingerlings transportation. Previously, many studies on live fish transportation in several species, such as shrimps, lobsters (Mohamed and Devaraj, 1997), barramundi (*Lates calcarifer*) (Rimer and Franklin, 1997), grouper (*Cromileptes altivelis*) (Slamet *et al.*, 2002), Nile Tilapia (*Oreochromis niloticus*) (Mugis, 2006; Orina *et al.*, 2014), goldfish (*Carrasius auratuss* Linnaeus) (Sufiyanto, 2008) and common carp *(Cyprinus carpio)* (Miranti, 2010).

Traditional transportations requires a lot of water to distribute the live fish, both; broodstocks or fingerlings. So it results in small volume of transportation and may cost prohibitive. Waterless live fish transportation become one of the recommended methods for fish distribution (Karnila and Edison, 2001; Miranti *et al.*, 2010; Kusyairi *et al.*, 2013; Zhang *et al.*, 2019). African catfish has ability to capture oxygen directly from the air because the arborescent organs (Mahyuddin, 2008). So, the waterless live fish transportation can apply at African catfish broodstocks distribution which is lack of water.

One of the success factor of waterless transportation can be determined from the packaging quality (Mohamed and Devaraj, 1997; Rimer and Franklin, 1997). One of the determinants of packaging quality is the filler medium. Filling medium such as sawdust, wood shavings, pieces of cloth, newsprint, foam, etc. have function as anchors for live fish to reduce fish movement (Miranti, 2010). So, it keeps temperatures low and reduce the fish respiration during the transportation. This study was aimed to evaluate the effect of different filler medium of waterless live fish transportation on survival rate of *Clarias* sp. broodstocks.

2. Materials and Methods

The Experimental Design

The experiment used completely randomized design with 25 treatments (4 medium treatment, 1 control treatment and 5 replicates per treatment) (Natzir, 1998; Sastrosupadi, 2000). African catfish brooders (mean weight 116 ±10,25g) obtained from the broodstock ponds of Laboratory of Fish Breeding and Reproduction, Faculty of Fisheries and Marine Sciences, Universitas Brawijaya, Malang, East Java and acclimated to room temperature (26-28^{o}C) for 1 week. Brooders were then transferred to other pond for 1 day without feeding before simulated 15 hours transportation. Bamboo bag with 40x25x15 cm^3 was used for specific design of waterless transportation bags. Brooders were packed at 5 fish/bags filled with different medium; 3 cm thickness of sponge medium and ½ kg for newspaper, cloth and sawdust medium per bags. One bags without medium was designed as a control. Before 15 hours simulated transportation, bags were dipped in cold water for 5 minute to moisture and decrease the temperature of the filler medium. Weight gain loss was monitored before and after simulated 15h transportation (Miranti, 2010). Then, temperature and humidity were measured by thermometer and hygrometer methods throughout the experiment, respectively. After simulated 15h transportation, the brooders were then conditioned each bag into individual aquariums. The parameters of survival rate, temperature, pH and DO monitored over a period of 14 days after simulated 15h transportation (Orina *et al.*, 2013).

Statistical Analysis

The raw data were normalized using some transformation depend on the type of data. All data were subjected to one-way and two-way analysis of variance (ANOVA) at level of significance of 0,01 and 0.05. A multiple comparison (LSD) test was used to examine significant differences among treatments using computer software SPSS 16.

3. Results & Discussion

Different filler medium of waterless live fish transportation had a significant effect ($p<0,05$) on survival rate of brooders with sawdust filler medium recording the lowest survival rate (24%) across all filler

medium, while 100 % survival rate recorded on sponge and cloth filler medium (Figure 1). Temperature parameter had no significant effect at simulated 15h transportation, while humidity had significantly decreased on newspaper filler medium (81,6 ±1,14 %) (Table 1). There was a significant effect of filler medium on weight gain loss of the brooders ($p < 0.05$) with sawdust filler media at end 15hr transportation (92 ± 10,37 g/bags) (Table 1). Skin damages of brooders due to filler medium was detected at end 15hr waterless live fish transportation (Figure 2). The post-transportation maintenance of African catfish brooders recorded death on each treatments. Daily mortality of brooders varies on each treatment (Figure 3).

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Highest survival rate at end 14 days post-transportation maintenance was recorded in control (without media) treatment (96%). No significantly different on control treatment, sawdust and newspaper filler medium. Sponge and cloth filler medium had lowest survival rate, 40 % and 44 % respectively (Figure 4). No significant changes ($p > 0.05$) were recorded for pH, DO and temperature at end 14 days post-transportation. The pH levels ranged from 6,32 to 6,63, while DO levels ranged from 26,0-26,5 mg/l and temperature levels ranged from 4,56°C to 4,86 °C. It was indicating that water condition was slightly changing towards basic (Table 2)

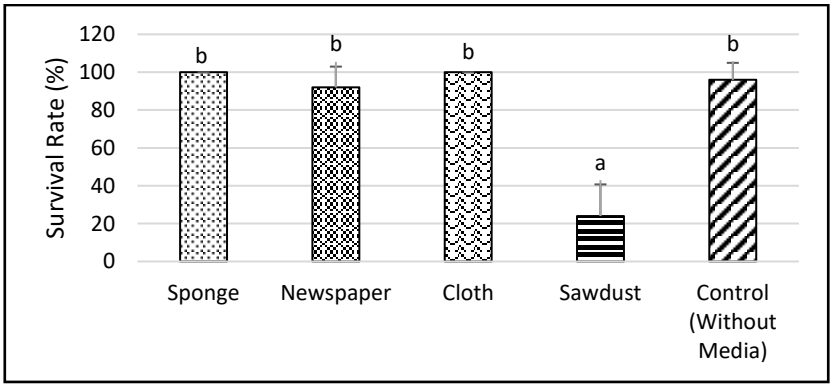

Figure 1. Accumulated survival rate of African catfish (Clarias sp.) broodstocks with different filler medium of waterless live fish transportation methods at end 15hr. Data with different letters indicate the significantly difference ($p<0.05$)

Table 1. Humidity (%), temperature (°C) and weight gain loss (g/bags) of African catfish (*Clarias* sp.) broodstocks with different filler medium of waterless live fish transportation methods at end 15 hr.

Treatment	Humidity (%)	Temperature (°C)	Weight Gain Loss (g/bags)
Sponge	83,3 ± 0,55^{b}	26,2 ± 0,45	74 ± 19,49^{a}
Newspaper	81,6 ± 1,14^{a}	26,4 ± 0,55	56 ± 26,08^{a}
Cloth	83,8 ± 0,45^{b}	26,0 ± 0,00	54 ± 24,34^{a}
Sawdust	83,4 ± 0,89^{b}	26,2 ± 0,45	92 ± 10,37^{b}

Control (Without Medium)	81,4 ± 0,89[a]	26,4 ± 0,55	83 ± 13,96[a]

Values are reported as mean ± S.E.M. Data with different letters in one column indicate the significantly difference ($p<0.05$)

Survival rate is the most important factors in waterless live fish transportation. Stress level during transportation influences the survival rate during the transportation. In this study, high mortality on sawdust media (86%) due to the high stress level because the skin damages through the simulated 15h transportation (Figure 1). Sawdust is able to absorb mucus and water through the surface of the skin contact with the capillary force, thus damaging the surface of the fish skin (figure 2). Fish mucus helps osmoregulation, reduces friction, protect from pollution, drying and UV radiation (Karnila and Edison., 2001; Grutter *et al.*, 2010). The mucus absorption of fish skin due to the filler medium also influence the weight gain loss during the transportation. Weight gain loss in waterless transportation is largely due to fluid loss (Miranti, 2010). In this study, sawdust filler medium has the highest weight gain loss with 92 ± 10,37 g/bags (Table 1).

Figure 2. Skin damages of African catfish (*Clarias* sp.) broodstocks due to filler medium of waterless live fish transportation at end 15hr.

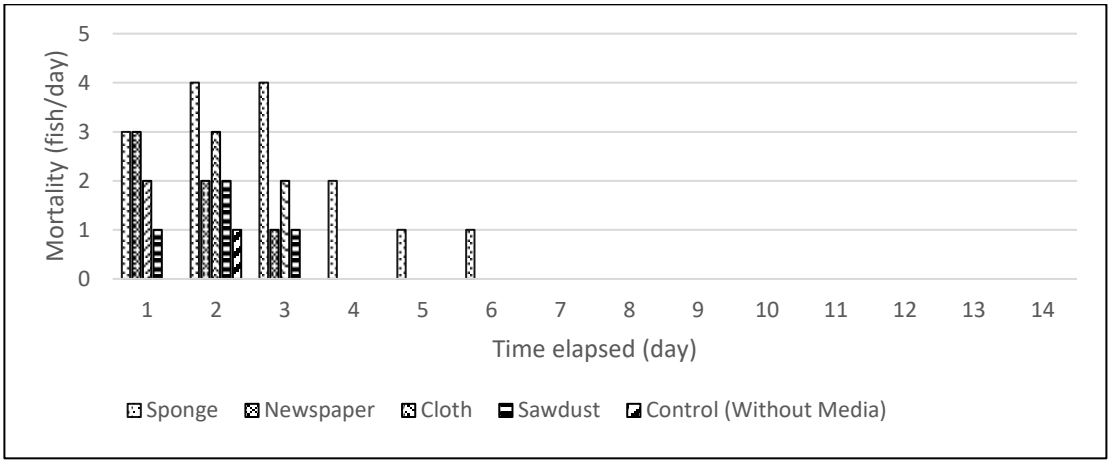

Figure 3. Daily mortality of the African catfish (*Clarias* sp.) brooders as a function of different filler medium of waterless live fish transportation in aquariums over 14 days post-transportation.

Humidity and temperature parameters during the waterless transportation depends on the amount of water vapor and transpiration (Kanginan, 2000; Arifin, 2003). The amount of available water absorbed by the filler medium and the evaporating water, causes the difference in humidity in waterless transportation of African catfish broodstock (Sufiyanto, 2008; Miranti, 2010). This study recorded that sponge, cloth and sawdust filler media had good ability to maintain the humidity level on 83 % (Table 1).

Temperature is an important factor for fish life (Boyd, 1982; Effendi, 2003; Effendi and Rizal, 2004). The rise of temperatures cause the increased speed of metabolism and respiration of aquatic organisms and subsequently lead to increased oxygen consumption (Effendie, 2003; Fujaya, 2004). No significant different recorded in this study in temperature parameter after simulated 15hr transportation (Table 1). Sponge, cloth and newspaper had good water absorption that maintaining humidity and temperature (Karnila and Edison., 2001; Gunarto, 2008; Sufiyanto, 2008).

Mucus loss and stress due to different filler during the simulated 15h medium of waterless live fish transport will reduce the immunity of the fish so that it will be susceptible to disease and increase the mortality at 14 day post-transportation maintenance (Fujaya, 2004; Grutter et al., 2010). It recorded that daily mortality of brooders varies on each treatment (Figure 2), sponge and cloth filler medium had the highest mortality (Figure 4) . While, study findings that water quality during post-transportation maintenance have the optimal pH, DO and temperature; 6,32-6,63, 4,56-4,86 mg/l and 26ºC-26,5ºC, respectively (Table 2). Water quality being maintained within recommended ranges (Boyd, 1982; Lesmana. 2001; Efendi, 2003; Efendi and Arifin, 2004; Mahyudin, 2008)

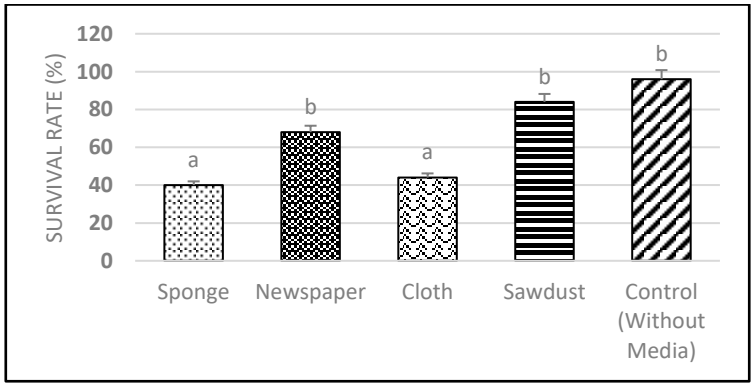

Figure 4. Accumulated survival rate of African catfish (*Clarias* sp.) broodstocks with different filler medium of waterless live fish transportation in aquariums over 14 days post transportation. Data with different letters indicate the significantly difference ($p<0.05$)

Table 2. DO (mg/l), temperature (ºC) and pH of African catfish (*Clarias* sp.) aquariums over 14 days post-transportation.

Treatment	Temperature (ºC)	DO (mg/l)	pH

Sponge	26,0	4,72	6,32
Newspaper	26,0	4,64	6,56
Cloth	26,0	4,56	6,58
Sawdust	26,0	4,86	6,63
Control (Without Medium)	26,5	4,67	6,60

7. Conclusion

Sponge and cloth filler medium on African catfish (*Clarias* sp.) broodstock waterless live fish transportation can be conclude as an effective filler medium in maintaining low temperature, humidity and survival rate during simulated 15hr transportation with 100 % survival. In addition, brooders did not experience a drastic weight gain loss. It is therefore recommended that *Clarias* sp. brooders transporters put into consideration sponge and cloth filler medium of waterless live fish transportation to minimize losses.

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