Utility of almond leaf (*Terminalia cattapa*) for improving growth and color quality of neon tetra fish (*Paracheirodon innesi*)

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Abstract. Ornamental fish farming is easy to stress, which results in fading colors and patterns of the body. The effort to maintain the color and pattern of the fish's body are using Almond leaf. This study aims to obtain the optimum concentration of Almond leaf in the maintenance of neon tetra fish, which is expected to improve the color quality and growth of fish. Neon tetra fish seeds measuring 1 - 2 cm were maintained in an aquarium sizing 25 cm x 40 cm x 28 cm with a stocking density of 4 tails liter⁻¹. The completely randomized design (CRD) was applied with four treatments and three replications. The different of Almond concentrations as a treatment i.e. 0 ppm, 250 ppm, 500 ppm, and 750 ppm. Parameters measured such as survival (SR), growth (absolute length and weight), color quality (lightness, chroma, hue a, and b) and glucose levels. Water quality measured such as DO, temperature, pH, conductivity, TDS, ammonia and nitrite. The results showed that Almond leaf affected the growth of absolute length and absolute weight. Almond leaf with a concentration of 500 ppm could improve color quality, especially for green-red colors.

1. Introduction

The Ornamental fish is a lot of interest to behave by the people who as a community on ornamental fish even in Indonesia and the other countries. One of these reasons is the ornamental fish have attractiveness whether in colors or the unique shapes. Therefore, the demand for the ornamental fish has been increased in a year by year which proofed by the production is 1.19 billion in 2014 [1]. The most of ornamental fish favored by hobbyist is Neon tetra (*Paracheirodon innesi*). The demand for this fish is 22.7 million in 1992 is export to America and predictably tend to increase [2].

The main problem of the ornamental fish culture is easy to stress that effect on color becomes fade. Thus, to improve the color quality is the need in order to keep whether the color and reduce the stress condition. One of the efforts has been conducted by using Almond leaf (*Terminalia cattapa*). The utility of almond leaf has famous in the fish farmers. Almond leaf have containing chemical compounds such as tannin and flavonoid that play an important role for antibacterial [3]. It is known that almond leaf has also anti-allergy, anti-inflammation, and anti-cancer. Almond leaf can influence the water quality, especially
the ammonia and pH values. The ammonia and pH are important water quality parameters for the fish culture which affect fish growth, survival and color quality.

The Neon tetra can live in the pH optimal that ranging from 5.5-7.5 [4]. 375 mg/L of almond leaf extract has influenced the survival of Betta sp. The dosage of almond leaf is 60 g/L can inhibit the bacteria, Aeromonas hydrophila growth where the old leaf is better than that of young leaf in terms of bacteria inhibition [3]. The objectives of this experiment are to determine the optimal concentration of almond leaf to improve growth, survival and color quality of neon tetra.

2. Materials and methods
The experiment was conducted to 70 days at Research Institute for Ornamental Fish Aquaculture, Depok, West Java, Indonesia. The fish test was neon tetra, Paracheirodon innesi which size of 1-2 cm in total length. 960 the fish test was acclimation for 7 days in the fiber tank with a water volume of 240 L before introducing to the aquarium with a size of 40 x 25 x 28cm. Each aquarium was completed by aeration and water heater and it was chlorination with a concentration of 30 ppm for 24 hours beforehand. Thereafter the aquarium was rinsed by tap water, then drying for 24 hours. The stocking density of the fish test was 4 fish/L in each aquarium. During the culture period, Tubifex was fed twice a day and bottom cleaning (Syphon) was conducted every day.

The almond leaf was rinsed and then dried. Thereafter, the vein and midrib were removed. To make the powder, the leaf was blended. The almond leaf powder was diluted by water based on the concentration as a treatment i.e. 0 ppm, 250 ppm, 500 ppm dan 750 ppm. The preliminary test was conducted in order to determine the optimal almond leaf powder dipping for 7 days by using Elisa reader. The result showed that the optimal of the almond leaf powder dipping was 3 days. Before the dipping of almond leaf powder, almond leaf powder was placed into the dip bag. The water exchange in the aquarium was conducted every three days, this condition based on the optimal concentration dipping of the almond leaf.

The parameters measurement i.e. survival rate, growth (absolute length and weight), color quality such as lightness, chroma, hue (LCH), and a and b values. The color quality was measured on days 0, 20, 40, and 70. Water quality parameters such as temperature, DO, pH, nitrite, and ammonia was a check on day 0 and 70. The blood glucose was analyzed using Glucose KIT on day 70. Statistical analysis using complete randomized design with three replicates and Duncan test was performed if there was significantly different between the treatments.

3. Results and discussion
3.1. The survival rate
The survival of the Neon tetra which used almond leaves were ranging from 86.3 – 87.9%. Based on statistical analyses revealed that no significantly different among the treatments (P>0.05). Thus, The almond leaf did not affect the survival at the present experiment (Fig. 1). Survival was influenced by environment conditions. Each organism has tolerated to adaptive on environment change. Food and environment are a limiting factor for fish culture [4]. At the present experiment, the environment such as water quality at all treatments showed within the optimal range for Neon tetra growth and survive. The present experiment suggested that the chemical compounds in the almond leaf have also inhibited the pathogen bacteria. Almond leaf has to contain chemical compound such as tannin and flavonoid that plays to inhibit bacteria [3]. Therefore, the fish showed healthy during the culture.
3.2. Absolute length and weight
The growth is an increase the length or weight at the time period [5]. The present experiment showed that both absolute length and weight were significantly different (P<0.05) at all treatments. The C treatment was higher compared to the other treatments in both absolute length and weight (Fig. 2) while the A treatment (control) was the lowest. This indicated that the almond leaf affects the absolute length and weight.

The similar results showed that catfish, *Pangasius* sp. cultured in almond leaf has a good response in terms of feeding compare to catfish culture without almond leaf and catfish cultured I without almond leaf showed susceptible to fish disease. Moreover, the pH at culture media using almond leaf was lower than
that of without almond leaf, this caused by tannin. The low pH value can increase the feeding response [3].

3.3. Color quality
The lightness, chroma, hue, a, and b values are parameters for checking the color quality. The values of these are presented in Fig. 3. On day 40 and 70, the lightness and chroma values showed significantly different (p<0.05) among the treatments. The Hue values were not significantly different among the treatments. The value showed that negative value, it is means that the color tends to green. The b value showed positive value, it is means that the color tends to yellow (Fig. 3).

The lightness value at A treatment at day 0 to 70 showed an increase at B, C, and D treatments were decreased. At the D treatment was the lowest compared to the others. The lightness was getting low, it means that the color tended to black bright and if the lightness was getting high, the color tended to dull white. Thus, the color of fish at D treatment tended to bright.

Chroma value at the A treatment on day 0 to 40 was increasing but on day 70 it was decreasing. At the B, C, and D treatments on days 70 were increasing which the highest found at D treatment. The Chroma value was high indicated that the color become dark, otherwise the color become fade. This proofed that the fish color at D treatment showed darker compared to the others.
Figure 3. The color quality of Neon tetra at different almond leaf concentrations

The hue (H) value on day 0-70 at the A, B, and D treatments showed increase while at the C treatment fluctuated. The highest of the hue value found at the D treatment. The hue value was ranging from 0-90 \(^\circ\), it means that the color was yellow-red, 90-180 \(^\circ\) was blue-green, and 180-270 was purple-blue. The present experiment showed that all of the treatments were ranging from 92-112 which the color was blue-green.

The value at all the treatments showed positive. At the C treatment, a value was the lowest compared to the other treatments. The b value was also positive at all the treatments. At the C treatment showed the highest compared to the other treatments. If the value positive, the color would appear red, otherwise the color appears combination between green-red. This indicated that the color tended to green where if b value positive, the fish will yellow color and if the b value negative, the color tends to blue [6]. The visualization of the Neon tetra color cultured at different treatments are presented in Figure 4.
Figure 4. The color of Neon tetra at different Almond leaf concentrations

The color of the fish at the A and B treatments having the white pale color and transparent compared to C and D treatments. At the C treatment, the color was clearly such as yellow-orange and green where at the D treatment was slightly appear yellow-orange and a little green (Fig. 4). This indicated that the C treatment was better than that of the other treatments in terms of the color.

3.4. Blood glucose

The blood glucose showed decreasing led to increasing in almond leaf concentration. AT the A treatment (without almond leaf), the blood glucose value was the highest, followed by B, C, and D treatments (Fig. 5). The blood glucose at the A, B, C, and D treatments was 227.93 mg/L, 226.84 mg/L, 225.14 mg/L, and 220.76 mg/L. The main indicator fish stress was increasing in blood glucose. This can be caused by the external environments such as temperature, pH, and f oxygen demand (DO), stocking density, and disease [7]. In this condition, the fish will spend much energy to survive then grow. The high spend energy would decrease fish growth [8]. The blood glucose at the A treatment showed the highest of blood glucose which indicated that fish in the stress condition.

Figure 5. Blood glucose of Neon tetra at different Almond leaf concentrations

3.5. Water quality

The water quality parameters during the experiment of neon tetra at the different treatment of almond leaf is presented in Table 1. Water quality parameters such as pH showed decreased by the end of the
The experiment, except for the A treatment was relatively constant. The Conductivity and TDS showed increased at B, C, and D treatment. The present experiment suggested that the almond leaf maybe containing chemical compounds that affect pH, conductivity, and TDS concentration. The extract of the almond leaf can reduce some of the water quality parameters, especially pH due to almond leaf extract containing tannin [9]. Although the present experiment the pH was decreased up to 5 this condition did not affect the neon tetra to survive and grow. The Neon tetra can survive in the pH value ranging from 4-8 [10]. The increasing the conductivity and TDS concentrations might be caused by the decomposition of the almond leaf in the water. The other water quality parameter i.e. temperature, DO, ammonia and nitrite were within the optimal range for Neon tetra culture.

Table 1. Water quality parameters during the experiment

| Parameters       | Treatment | A          | B          | C          | D          |
|------------------|-----------|------------|------------|------------|------------|
| DO (ppm)         | Day 0     | 6.08-6.01  | 6.02-6.08  | 6.25-6.13  | 6.13-6.22  |
| Temperature (°C) | Day 70    | 28.7-29.3  | 28.4-29.5  | 28.6-29.7  | 28.4-28.6  |
| pH               |           | 6.81-6.88  | 6.74-6.82  | 6.80-6.86  | 6.77-6.81  |
| Conductivity (μs cm⁻¹) | Day 0     | 113.7-114.2| 116.0-116.8| 114.0-116.2| 115.3-116.0|
| TDS (ppm)        |           | 56.0-56.4  | 56.7-57.0  | 55.0-57.7  | 56.2-57.3  |
| Ammonia (ppm)    |           | 0.01       | 0.01       | 0.01       | 0.01       |
| Nitrite (ppm)    |           | 0.01       | 0.01       | 0.01       | 0.01       |

| DO (ppm)         | Day 70    | 6.70-7.12  | 6.56-6.85  | 6.66-6.81  | 6.79-6.88  |
| Temperature (°C) |           | 29.1-29.2  | 28.7-28.9  | 28.7-29.1  | 28.8-29.2  |
| pH               |           | 6.55-6.84  | 6.11-6.21  | 5.77-5.81  | 5.11-5.34  |
| Conductivity (μs cm⁻¹) | Day 70    | 186.2-189.0| 202.7-217.0| 198.2-227.4| 191.7-208.7|
| TDS (ppm)        |           | 80.9-91.2  | 96.3-105.7 | 98.8-109.7 | 94.6-107.3 |
| Ammonia (ppm)    |           | 0.01       | 0.01-0.02  | 0.01-0.02  | 0.01-0.02  |
| Nitrite (ppm)    |           | 0.01-0.02  | 0.01-0.02  | 0.01-0.02  | 0.01-0.02  |
4. Conclusion
The utility of almond leaf for three days is the optimal time. The almond leaf affects the fish growth. The experiment revealed that the C treatment was better than the other treatments. The almond leaf affects the pH, conductivity, and TDS. The almond leaf can improve the color.

5. References
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