Transactions on Science and Technology, **3**(2-2), 382 - 387, 2016
ISSN: 2289-8786

The Effects of Stocking Density, Substrate and Coloration in Rearing Giant Freshwater Prawn (*Macrobrachium rosenbergii*) Post Larvae

Hasnita Che Harun*, Nora Azreena Ismail, Khairiyah Mat, Nor Dini Rusli, Tan Sze Huay, Muhd Hazizi Ismail, Hazreen Nita Khalid, Lee Seong Wei, Suniza Anis Mohamad

Faculty of Agro Based Industry, Universiti Malaysia Kelantan, Jeli Campus, Locked Bag No. 100, 17600 Jeli Kelantan, MALAYSIA.
*Corresponding author. E-Mail: hasnita@umk.edu.my; Tel: +609-9477174; Fax: +609-9477022.

Received: *27 April 2016*
Revised: *1 August 2016*
Accepted: *1 September 2016*
Online: *27 October 2016*

Keywords:
Macrobrachium rosenbergii; Fresh Water Prawn; Stocking Density; Substrate; Coloration

ABSTRACT

Understanding *Macrobrachium rosenbergii* optimum condition and performance in aquaculture is important to optimize the design, management of tanks, and other culture conditions. The objective of this study was to investigate the effects of stocking density, presence of substrate as well as coloration in rearing *M. rosenbergii* post larvae (PL). Three experiments were conducted for 28 days to determine 1) the effects of stocking density of 160 PL/Liter, 140 PL/Liter and 120 PL/Liter, 2) effects of presence of substrate and 3) application of colouration. Each treatment was run with untreated samples of *M. rosenbergii* at condition of 140 PL/Liter as control. Data obtained from the study were analyzed using Analysis of Variance (ANOVA) available from Statistical Package for the Social Sciences (SPSS) software version 19.0. The highest growth performance in the stocking density, substrate and coloring treatment was obtained in thr group 120 PL/liter (with substrate) with weight gain of 0.0775± 0.0132g and length gain of 11.0 ± 1.88 mm. The best survival percentage in the substrate and coloring treatment was obtained in the 120 PL/Liter (coloring) with 88.500 ± 3.78 %. There are no significant different ($P \geq 0.05$) among all treatments. The presence of substrate and coloring in rearing *M. rosenbergii* can be considered as optimum condition provided water quality maintenance. Presence of coloring is suitable to increase survival percentage for short period of time such as during transportation. Hence, it gives high survival percentage but did not benefit in term of growth.

Introduction

Macrobrachium rosenbergii de Man (1879) is one of the most popular aquaculture species throughout its natural habitats and even beyond. This species has already being exported and cultured in as far as Brazil (New, 2002). The farming of giant freshwater prawn was divided into three phases. The first two phases are hatchery and nursery farm where it will take about 2 to 3 months before grow out farm which will take about 8-10 months (Lalrinsanga *et al*., 2012). This species breeds throughout the year under optimum climatic conditions. However, in many areas of Malaysia, the peak breeding activity occurs during monsoon season especially from October to January.

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Spawning takes place between midnight to early in the morning (http://www.celkau.in/Fisheries/CultureFisheries/Freshwater%20Prawns/hach.aspx). Generally, through report and data that were published in 2011 from *Food and Agriculture Organisation* (FAO) the top three prawn producer countries are China, Thailand and Viet Nam (http://www.fao.org/fishery/culturedspecies/Macrobrachium_rosenbergii/en).

According to Niu *et. al.* (2003), there are several environmental factors that contribute to the optimum condition of aquaculture species including temperature, light salinity, water quality and nutrition. Therefore, the present study aims to investigate the optimum condition for rearing *M. rosenbergii* to improve the nursery and grow out farm production in Malaysia.

Methodology

Sampling

A total of 1500 post larvae (PL 15) were purchased from Pusat Penetasan Udang Galah, Sitiawan, Perak and transported to Animal Husbandry Laboratory, Universiti Malaysia Kelantan (UMK), Jeli Campus in 45 x 80 cm oxygenated bags. PL were acclimated for 4 days and fed twice daily with commercially available pellet before the experiment started.

Experimental Design

The experiment was divided into three treatments: 1) different density of PL, 2) presence of substrates and 3) application of coloration in the rearing water tank of PL. Initial weight and total body length was measured for each PL. For each treatment group, data of survival rates were collected daily and weekly for growth performance over a period of 28 days. The survival percentage was recorded by calculating the mortality rates. The growth performances were measured from the total body length and body weight. The total body length (length from rostrum to telson) was measured using vernier calipers. Water quality parameters (pH, salinity, dissolve oxygen, temperature and ammonia) were measured daily using the YSI 556 MPS Handheld Water Quality Meter (YSI Industries, Yellow Springs, Ohio, USA). PL were fed twice daily with commercially available pellet throughout the experiments. 100 W bulbs were placed on the top of the tanks to keep the temperature at optimum (27-30°C) especially during night and rainy days.

Stocking Density

Three different stocking densities consist of 160 PL/Liter, 140 PL/Liter and 120 PL/Liter were design with the presence of substrates. Each treatment group was run with 4 replicates. Other parameters such as temperature, salinity, dissolved oxygen, ammonia and pH were kept at optimum condition.

Presence of Substrate

Density of the PL for the treatment groups with substrate was 60 PL/Liter. Density of the control group, without substrate, was also 60 PL/Liter. Type of the substrate used in the study was black nylon netting (approximately about 50 cm^2). Each group was replicated four times.

Application of Color

Blue aquatic coloring was used (10 drops) as coloring agent. The density of the PL for this treatment was 60 PL/Liter. The control group was without coloration with the density of 60 PL/Liter. This experiment was run with four replicates.

Data Analysis

One-way Analysis of Variance (ANOVA) available from Statistical Package for the Social Sciences (SPSS) software version 19.0 was used to analyze the data collected.

Result and discussion

Growth Performance

The highest growth performance in the stocking density, substrate and color treatment was obtained in the group 120 PL/Liter (with substrate) with weight gain of 0.0775 ± 0.0132 g and length gain of 11.0 ± 1.88 mm. Followed by the 140 PL/Liter (substrate) group with 0.0625 ± 0.0109 g of weight gain and 9.4 ± 1.63 mm of length gain respectively. The least weight gain was recorded in 120 PL/Liter (with coloring) (0.0572 ± 0.0098 g) group but the least length gain was in 160 Liter/Liter (9.7 ± 1.70 mm) group. There are no significant different (P≥0.05) among all treatments.

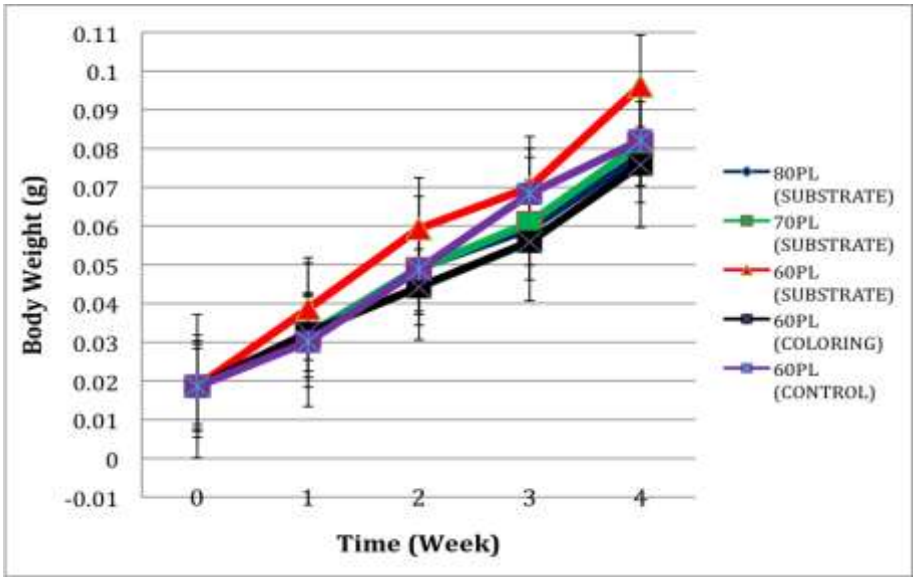

Figure 1. Body weight performance of *M. rosenbergii* PL

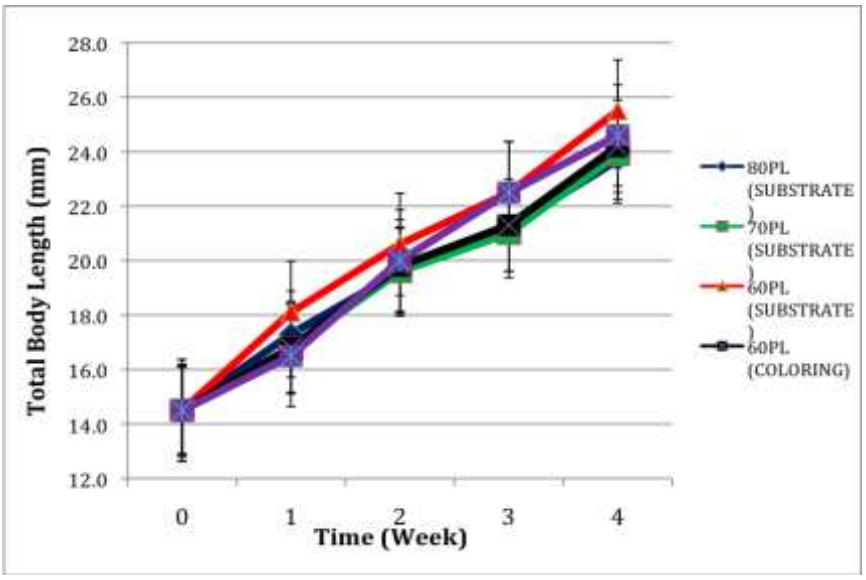

Figure 2. Total body length performance of *M. rosenbergii* PL

Survival Rate

The best survival percentage in the stocking density treatment was obtained in 120 PL/Liter (substrate) (77.760 ± 7.85 %) group. The least survival percentage was recorded in 160 PL/Liter (substrate) (72.064 ± 10.64%) group. There are no significant different (P≥0.05) for survival percentage among the stocking densities.

Meanwhile, the best survival percentage in the substrate and color treatment was obtained in the 120 PL/Liter (coloring) with 88.500 ± 3.78 %. The least survival percentage was recorded in 120 PL/Liter (substrate) group with 77.760 ± 7.85 %. There are no significant different (P≥0.05) among the survival percentage.

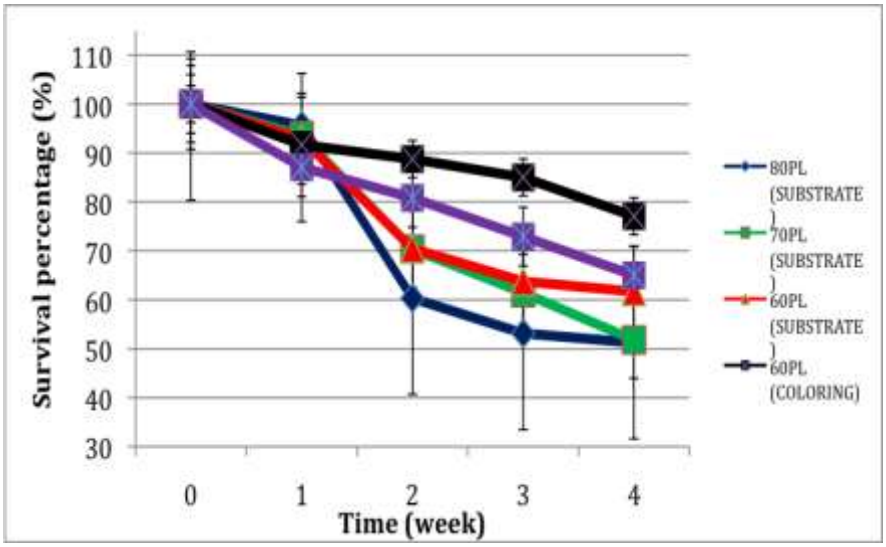

Figure 3. Survival percentage of *M. rosenbergii* PL

Both growth performance and survival percentage of each tank with the presence of substrate decreased started from week 2 to 3. This is because the accumulation of ammonia in the tanks. New *et*

al. (2002) pointed out that horizontal placing of the black nylon netting, such in the current experiment may complicate the cleaning process.

Mamun *et al*. (2010) supported that growth rate improved in presence of artificial substrates but did not benefit to survival rate. On the other hand, the present study showed the least survival percentage in 120 PL/Liter (with substrate) group with 77.760 ± 7.85 %. The reason of this decline might be due to the high accumulation of ammonia in the substrate during week 2 to week 3.

For the color treatment, the dark blue coloring signifies low light penetration. Thus, it gives darker environment in the rearing tank. This situation leads to less aggressive activities and cannibalism. Yasharian *et al*. (2005) reported that dark (black, blue, green) interior color tank resulted in the highest survival and the tank coloration may serve as a calming agent as well as reducing cannibalistic behavior.

The 120 PL/Liter (coloring) group recorded the least growth performance. The dark environment of water limits the ability of the PL to find feed. As the result, the PL becomes less active. Less active or less metabolic rate will lead to lack of molting. At the end, the PL suffered slow growth performance. Result from the present study is inline with Yasharian *et al.* (2005) study, where they found that the speed and distance of horizontal movement of the larvae increased three times in white containers, as compared with those grown in the black containers.

Conclusion

PL with the density of 60 PL/Liter with the presence of both black nylon netting substrate and blue coloration can be considered as optimum condition for rearing *M. rosenbergii* PL in this experiment. In addition, presence of coloring will increase survival rate but did not significantly improve growth performance of *M. rosenbergii* PL.

Acknowledgements

Special thanks goes to the Ministry of Higher Education (MOHE) for providing the Fundamental Research Grant Scheme (FRGS) (R/FRGS/A07.00/00127A/001/2014/00146) to conduct the present study.

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