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Growth and survival rate of giant freshwater Prawn *Macrobrachium rosenbergii* (De Man, 1879) fed with *Terminalia catappa* seed meal

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Abstract

Aquaculture's role in economic development, health and environment is very substantial. Giant freshwater prawn (*Macrobrachium rosenbergii*) comprises an important fishery in many natural freshwater bodies in several tropical and sub-tropical countries all over the world. This study evaluated the effect of incorporating potential plant-based feedstuff in aquaculture, specifically the *Terminalia catappa* seed meal (TCSM) on the growth characteristics and survival rate of the cultured prawn. The experiment was carried out for 60 days in freshwater tanks in three (3) replications with the following treatments: T0- Control (Commercial Feeds), T1- 5%, T2 - 10% and T3- 20%, which were laid out in Completely Randomized Design (CRD). Data were subjected to One way ANOVA at p=0.05. Results showed that those fed with 10% TCSM in Treatment 2 got the highest growth increment of 7.09 g in weight and 17.93 mm in length. Specific growth rate of 11.82 %BW day^{-1} and 29.88 %day^{-1} in terms of weight and length respectively were also obtained from Treatment 2. For the survival rate, prawns fed with 10% TCSM also got the highest survival presentage of 98% which is significantly higher than the control treatment. Results suggested that incorporation of *Terminalia catappa* seed meal in prawn diet is a potential supplementation for better growth as well as survival of giant freshwater prawn (*Macrobrachium rosenbergii*).

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Introduction

Aquaculture has been in history and involves many species and farming practices in diverse ecosystems. In the Philippines, aquaculture is categorized according to environment, farming system, farming technology and production. Most of the production comes from the farming of seaweed, milkfish, tilapia, shrimp or prawn, carp, oyster and mussel.

Giant freshwater prawns (*Macrobrachium rosenbergii*), also known as *Ulang* in the Philippines, are aquatic animals that have an important ecological role for the environmental dynamics of the ecosystems of rivers and lagoons (Murphy and Austin, 2005). They are considered omnivores and scavengers. This species is known in freshwater aquaculture industry because it is hardy and easily cultured. As reported, the production of this prawn was over 99% particularly in Asia (Tambalque *et al.*, 2015). Giant freshwater prawn commends high economic value due to their high protein content, good taste and visual appeal, making them well-priced product as food for human consumption. It is a good source of healthy food for human consumption and animal proteins for livestock (Marques *et al.*, 2016). They can be reared in a variety of freshwater enclosures, including tanks, irrigation ditches, cages, pens, reservoirs and natural waters (FAO, 2020).

Plant derivatives have been widely studied all over the world to minimize production inputs in aquaculture. The development of plant component as inputs in aquaculture contributed into more economic as well as efficient techniques which will eventually be an advantage not only economically but also environmentally. Plant products have also been reported to stimulate appetite and promote growth, function as immunostimulants, antibacterial and antiparasitic (Citarasu, 2010).

Terminalia catappa or tropical almond, also known as indian almond, malabar almond and false kamani is a large tropical tree in the leadwood tree family and mainly grows in the tropical regions of Asia, Africa and Australia. It grows to a height of 3 to 8 meters and bears a fruit that is ellipsoid in shape with a bluntly pointed apex and the fruit is about 7.51 cm long and 5.05 cm thick. According to Burkill (1998), *T. catappa* produce fruits twice in a year and it are estimated that only about 20 present of the fruit is consumed, the remaining 80 present being wasted. It is a source of raw materials for feed ration formulation which is known among nutritionists especially because of its very high protein content (19 present to 22 present) and oil which is 50 present to 52 present. It is also a rich source of protein and Vitamin E, containing 24mg/100g. It was also reported that inclusion of *T. catappa* seed meal is good for growth performance and haematology parameters of the fish (Julius and Mariatu, 2015).

T. catappa seed has been reported to be nutrient-rich feedstuff for livestock; however information on its potential as a feed enhancer has not been well documented in aquaculture, specifically on crustaceans. Thus, this study aims to evaluate the effect of *T. catappa* seed meal as feed enhancer on the survival and growth performance of giant freshwater prawn.

Materials and methods

Research design

This study used a single factor design laid out in Completely Randomized Design (CRD) in freshwater circular tanks with four (4) treatments: T0- Control (Commercial Feeds), T1- 5%, T2- 10% and T3- 20% in three (3) corresponding replications. The experiment was done for 60 days.

Tank preparation and stock procurement

The study was conducted at the Bureau of Fisheries and Aquatic Resources- Freshwater Fish Farm, Caluwasan, Clarin, Bohol. A circular polyvinyl chloride (PVC) tank with a diameter of 1.2 meters and 1.4 meters in height was used.

The 180 healthy freshwater prawns were secured from BFAR Clarin, Bohol, Philippines. The prawns with an initial ABW of 5 grams were stocked in each compartment at a rate of 15 individuals per m^2.

Feed preparation

T. catappa mature fruits were collected and were dehulled manually by crushing the shell or endocarp using a hammer to remove the fleshy nuts. The seed or nut inside the endocarp were pounded and weighed according to treatments (T0- Control (Commercial Feeds), T1- 5% TCSM, T2- 10% TCSM and T3- 20% TCSM). Feeding was done three (3) times a day, 7:00 in the morning, 12:00 noon and 6:00 in the late afternoon using broadcasting method. Daily feed allocation depended on the average body weight of the prawns and was adjusted every 15 days. Feeding rate used was based on the SEAFDEC Freshwater Prawn Culture Technoguide.

Growth, survival and water quality monitoring

Initial weight (g) and length (mm) of the culture species were carried out prior to stocking. Sampling was done every fifteen (15) days to determine the ideal feeding rate and daily feed allocation of the cultured species. Water parameters such as temperature (˚C), pH and ammonia level were monitored daily.

The stocks were harvested after 60 days, counted individually and weighed using 0.1g precision electronic weighing scale and length measured using Vernier caliper to the nearest 0.01cm. In computing the growth increment (GI), specific growth rate (SGR) and survival rate (SR), the following formulas were used: Growth Increment = W2–W1, where W1 is the initial mean weight of prawn at the beginning of the experiment and W2 is the final mean weight of prawn at the end of the experiment. SGR = [(ln final weight–ln initial weight)/days] x 100. Where: ln= natural logarithm of final and initial weight. SR = (recovered stocks/total stocks) × 100.

Statistical analysis

All data were subjected to one-way Analysis of Variance (ANOVA). Differences were considered significant at the $p < 0.05$ level.

Results and discussion

Growth, survival, and mean water quality parameters of the cultured giant freshwater prawns were presented in Table 1. The experimental prawn fed with TCSM showed an increment, which indicated that the prawns responded positively on the introduced feed and that the protein in TCSM were utilized effectively. Growth increment and specific growth rate in terms of weight were higher in prawns fed with 10% TCSM at 7.09 grams and 11.82 %BW day-^{1}, respectively. Similarly in terms of length, prawns fed with 10% TCSM in Treatment 2 also got the highest growth increment and specific growth rate among other treatments at 17.93 mm and 29.88 % day-^{1}, respectively. Results further showed that incorporation of *Terminalia catappa* seed meal (TCSM) in the diet improved the growth of Giant freshwater prawn. This corroborated with the report of Ezeokonkwo and Dodson (2004) that the seed of *T. catappa* has essential amino acid that can support growth. Moreover, Elezuo *et al.*, (2018), also stated that the uses of T. catappa kernel or seed have increased the growth of *Clarias gariepinus* juveniles and thus a potential protein source as alternative to soybean meal.

Table 1. Growth Increment (GI), Specific growth rate (SGR) and survival rate (SR) of Giant freshwater prawn (*Macrobrachium rosenbergii)*

Treatment	GI in weight (g)	GI in length (mm)	SGR in weight (%BW day-1)	SGR in length (%day-1)	SR (%)
T0	5.53	14.47	9.21	24.15	82
T1	6.02	16.93	10.03	28.21	93
T2	7.09	17.93	11.82	29.88	98
T3	5.90	15.73	9.83	26.21	92

The survival rate in Treatment 2 got the highest presentage of 98 present and was significantly higher compared to the control treatment which is 82 present. Most of the mortality happened during the moulting stage of the cultured Freshwater prawn, where the prawns' resistance to infections and stress are weak and cannibalism also happens. *T. catappa* is known to aid health, vigour as well as in the recovery of diseases or damages in fish (Purivirojkul, 2012).

Table 2. Ranges of water parameters in the culture of Giant Freshwater Prawn (*Macrobrachium rosenbergii).*

Treatments	Water Quality Parameters		
	pH	Temperature (°C)	Ammonia (ppm/mg/L)
T_0 - Control (Commercial Feeds)	7.04 – 7.96	25.8 – 29.3	0
T_1 – 5%	7.07 - 7.96	25.7 – 29.0	0
T_2 – 10%	7.03 – 7.94	25.9 – 28.9	0
T_3 – 20%	7.00 – 7.99	25.6 – 28.7	0

The water quality parameters recorded during the experiment were within the tolerable range for giant freshwater prawn culture in tanks (Table 2). The average range for pH was 7.0 - 7.99, temperature at 25.6-29.3 °C and the ammonia level is at 0 ppm/mg/L across all treatments. Maintaining optimum water quality is very important for giant freshwater prawn culture since these prawns typically thrive in natural rivers, lakes, swamps, estuaries and other inland bodies of water. Any fluctuations of these parameters may affect growth and survival of the cultured prawn.

Conclusion

In conclusion, the addition of *Terminalia catappa* seed meal in the diet of giant freshwater prawn has showed increment in the growth and survival of the cultured species. An inclusion of 10% TCSM in the daily feed allocation of the giant freshwater prawn is a potential feed supplementation to minimize production inputs and improves survival in prawn aquaculture.

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