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***Research Article** (Open Access)*

EFFECT OF PROBIOTIC ON GROWTH AND SURVIVAL OF *LITOPENAEUS VANNAMEI* FROM THE CULTURE PONDS OF VADACHEEPURUPALLI, VISAKHAPATNAM, ANDHRA PRADESH, INDIA

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ABSTRACT
The purpose of the present study is to estimate the growth and survival percentages of *L. vannamei* from the culture ponds of Vadacheepurupalli with the application of probiotic (PRO-2) along with 1, 3 β-Glucan. This study was conducted over a period of 120 days for each crop during the year 2019. The study was conducted in two different crops i.e. summer crop and winter crop. The standard water quality parameters were maintained throughout the study period. Experiments were conducted in three different ponds. One is treated as control pond and other two ponds (Pond-A and Pond B) as experimental ponds. It is evident from the present study findings that, the overall highest growth and survival of the shrimps were recorded in the experimental ponds (treated with probiotics) than control one during culture period from the selected station. Based on the results obtained in this study the probiotics have beneficial effects on the growth and survival by enhancing gut activities and other metabolic processes. During summer crop in the control pond the survival rate of shrimp was 80%. The highest survival was recorded in Pond-A (91%), and lowest survival was reported in Pond-B (89%). During winter crop in the control pond the survival rate of shrimp was 79%. The highest survival rate was recorded in Pond-B (88%), and lowest survival rate was recorded from Pond-A (85%).

Keywords: *Probiotics, L. vannamei, Growth, Survival.*

INTRODUCTION
Penaeus monodon culture was more prominent during last few years, until the white spot syndrome virus affected the culture ponds. Due to WSSV the majority of the *P. monodon* crops was collapsed and lead to massive economic loss to shrimp culture practices in Asian region. Keeping in view of this, the Coastal Aquaculture Authority of India has introduced a new species called *Litopenaeus vannamei* for the commercial practices in 2009. Now-a-days this species has gained much importance for the farming purposes in all areas of the Coastal Districts in Andhra Pradesh, India (Balakrishnan *et al.*, 2011).

There are so many reasons to introduce this new species for Commercial operations in India. The *L. vannamei* are quite comfortable for low saline waters, the experimental evidences for this species was reported in other overseas countries and also in India by Samocha *et al.*, (2002). The *P. vannamei* has some of the prominent features such as speed growth rate, less chances to prone diseases, high degree of tolerance to various physico-chemical parameters. Keeping in view of the above mentioned aspects the *P. vannamei* species has new option to replace *P. monodon* culture.

Currently in shrimp farming practices, *P. vannamei* is most widely cultured species all around the world because of its inherent capabilities like disease resistance, adoptable to wide range of salinities and water fluctuations (Boyd, 2002; Zhu *et al.*, 2006). In culture of *P. monodon* the role and effect of probiotics was well executed by Soundarapandian *et al.*, (2010). The growth and survival of *P. vannamei* was studied

against various levels of stocking densities by Balakrishnan *et al.*, (2011). The role of artificial diets on the growth and survival of *P. vannamei* was well studied in brackish water during summer season by Ravuru and Mude (2014). Some important previous studies revealed that, when the shrimps were fed with probiotics changes occurs in the growth performance by means of feed efficiency, and feed conversion ratios as reported by Boonthai *et al.*, (2011) and Zokaeifar *et al.*, (2012, 2014). In addition to capability of probiotics in enhancing the growth performance, they have influence on the enzymes present in the gut of the host is believed to be one of significant contribution. According to Becerra-Dorame *et al.*, (2012) the nutritional condition of the cultivable animals affected on both given feed and their digestive physiology. Digestive enzymes are very much essential to breakdown the complex compounds into simple compounds and absorbable molecules that can be utilized by the host animal as reported by Lazado *et al.*, (2012). Actually the utilization of feed related material is greatly depends on whether they can be easily absorbed or not by the host digestive physiology. Hence in the present study an attempt has been made to evaluate the effect of probiotic (PRO-2) and their impacts on the growth and survival of *L. vannamei* from the culture ponds of Vadacheepurupalli, Visakhapatnam, Andhra Pradesh, India.

MATERIALS AND METHODS

Preparation of the Pond and Feeding Methods

At first, the culture ponds used in this study were allowed to dry and crack to increase the hydrogen sulfide's capacity and get rid of fish eggs and other predators. After that, the soil's obnoxious gases were thoroughly removed by plowing the bottom of the pond to a depth of 35 cm. After 21 days, the ponds are ready for culture operation. A local commercial hatchery supplied healthy seeds were stocked at a density of 13 seeds per square meter. Seed bags were allowed to float on the surface of the water in each pond for 35 minutes to help the seeds get acclimatized to the atmosphere of the pond. The seed bags were then slowly opened and released into the pond water. Standard methods were employed for the water quality analysis during the study period.

CP feed (Charoen Pokhpond Aquaculture India Pvt. Ltd.) was used to feed the shrimps. The feed chart provided by the CP Company served as the basis for the feeding schedule. Based on the check tray observations and body weight sampling, four check trays were installed in the ponds. Feeding schedule was adjusted as per the chart given by the company and four times in a day, in the morning (6:00 AM), afternoon (12:00 PM), evening (6:00 PM), and night (10.00 PM), respectively. The total feed used per day was monitored. For feed broadcasting the rope method was adopted for the current research work. In most cases, the water exchange was not done for the first 30 days; after that, 15 to 18 cm of water was changed every ten days. The shrimps were sampled at regular intervals, and the survival rate, average body weight, and individual shrimp weights were estimated.

RESULTS

Shrimp growth in summer and winter crops

The recorded values for the estimation of growth were interpreted in graphs from 30 days to 120 days of shrimp culture. During summer crop in the control pond the growth values fluctuated between 2.59±0.19 to 17.21±0.55. The maximum growth of 20.98 g on 103rd day was observed in the control pond but this pond was harvested due to whitespot disease incidence. Similarly ponds treated with probiotics the values for pond-A ranged from 3.41±0.22 to 28.47±0.56 and for pond-B the values ranged from 3.61±0.39 to 29.84±0.31 (Figure 1).

During winter crop in the control pond the growth values fluctuated between 2.31±0.22 to 16.29±0.55. The maximum growth of 18.97 g on 98th day was observed in the control pond but this pond was harvested due to whitespot disease incidence. Similarly, ponds treated with probiotics the values for pond-A ranged from 3.26±0.19 to 27.45±0.38 and for pond-B the values ranged from 3.72±0.33 to 28.94±0.61 (Figure 2).

Survival Rates in summer and winter crops

The survival rate of *P. vannamei* was recorded from two different crops during the year 2019. It is evident from the present study findings during summer crop in the control pond the survival rate of shrimp was 80%. The highest survival was seen in Pond-A (91%), and lowest survival was recorded in Pond-B (89%). During winter crop in the control pond the survival rate of shrimp was 79%. The highest survival rate was seen in Pond-B (88%), and lowest survival rate was reported from Pond-A (85%) (Figure 3).

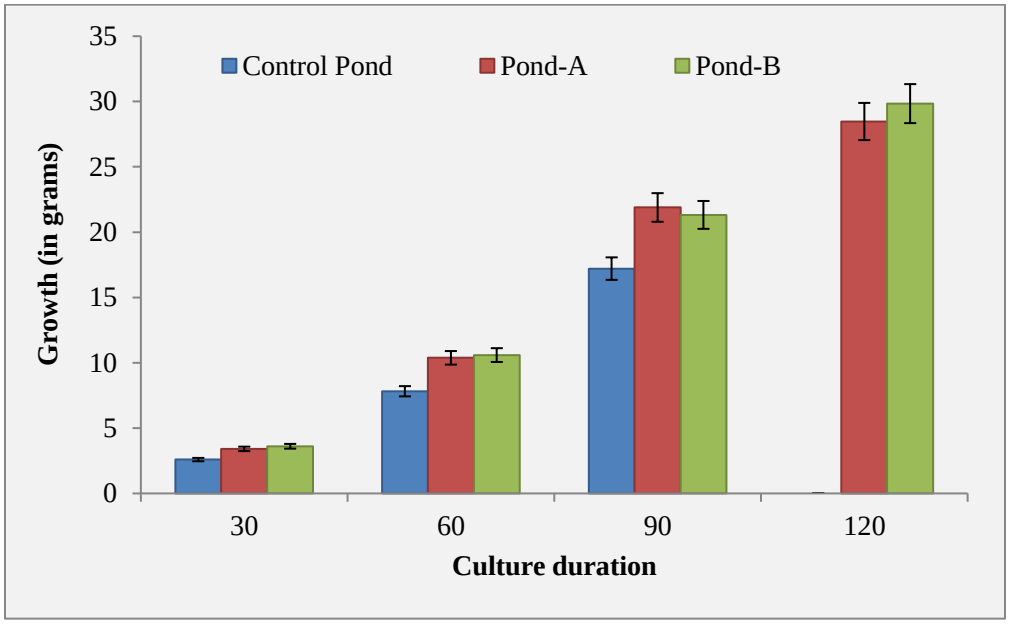

Figure 1. Growth of *L. vannamei* during summer crop

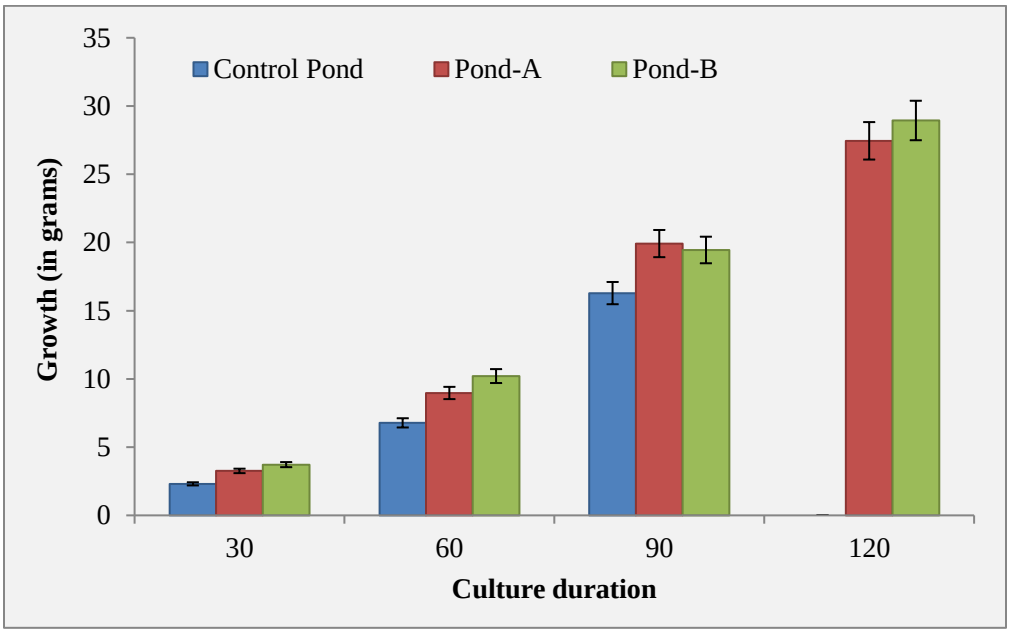

Figure 2. Growth of *L. vannamei* during winter crop

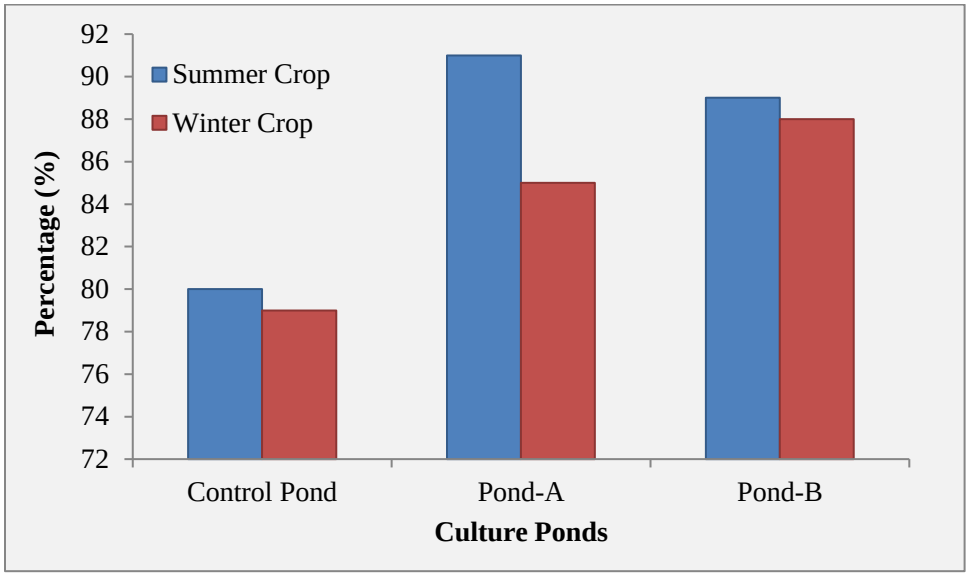

Figure 3. Percentage survival comparison for summer and winter crops of *L. vannamei*

DISCUSSION

For any farm reared shrimp species, the quality of the pond water play a prominent role in attaining optimum growth and survivals. Usually, the water quality always depends on the un-utilized feed, feces and metabolic wastes delivered during culture process (Soundarapandian and Gunalan, 2008). The major water quality parameters such as temperature, salinity, pH and dissolved oxygen play significant role in overall process of the culture. Chakravarty *et al.*, (2016) reported the highest percentage survival rates of *P. vannamei* larvae when the temperature ranges in between 26.5ºC to 28.0ºC. Darwin *et al.*, (2017) suggested that penaeid shrimp species were able get maximum growth and survival rates when the temperature ranges in between 25.5ºC to 28ºC. Ponce-Palafox *et al.*, (1997) recorded moderate survival rates when temperature ranges in between 20 to 30^0C. Similarly higher growth and survival rate was recorded when it was in the ranges of 28 to 30ºC (Ponce-Palafox *et al.*, 1997). In the present investigation the maximum growth and survivals were reported in the culture ponds of Vadacheepurupalli where the temperature values were fluctuated between 25ºC to 29ºC.

Salinity has prominent role next to temperature that influence the growth and survival of the organisms (Jamabo, 2008). The larvae of *P. vannamei* can be able to tolerate wide ranges of salinity fluctuations in the pond water (Sturmer and Lawrence, 1989; Bray *et al.*, 1994; Ponce-Palafox *et al.*, 1997). This is well in agreement with the studies of Samocha *et al.*, (1998), they have conducted experiments with *L. vannamei* with the salinities of 2ppt, 4 ppt, and 8 ppt. There is no much difference in the growth rates of larvae at three varied salinities. Similarly in the present study the salinity values were fluctuated between 16 to 27 ppt in the culture operation of *P. vannamei*. The findings of the present study are well in agreement with the findings of Soundarapandian and Gunalan, (2008).

pH has its own role in the pond water. It depends on number of factors which includes soil buffer capacity, biological activity, and pond source water. Usually low buffer capacity of the pond water enhances the pH, which resulted in poor production because of high mortalities (Boyd, 1982). pH range of 7.9-9.1 is ideal for *L. vannamei* which resulted in maximum survival rates (80-92%) reported by Balakrishnan *et al.*, (2011). pH range of 6.5-9.0 is ideal for shrimp culture reported by Boyd (1990). pH range of 7.5-8.5 is ideal for *P. monodon* (Ramakrishnareddy, 2000). Similar trends of survival rates were recorded in the present study as the pH concentration was found to be varied from 7.2 to 8.6 in the shrimp culture ponds of Vadacheepurupalli.

The levels of Dissolved oxygen influence the major metabolic activities of the cultured species (Molluae, 2000). Re and Diaz (2011) observed highest production of *Litopenaeus stylirostris* in hatchery system when the species cultured at 6mg/lit dissolved oxygen. Sayeed *et al.,* (2009) recorded 4-10 mg/lit of dissolved oxygen favors the production of penaeid shrimps. Similar trends of production and growth rates were recorded in the present study. In the present study the DO concentration was found to be varied from 4.5 to 7.5 in the shrimp culture ponds of Vadacheepurupalli.

In the present study an attempt has been made to test the performance of commercially available feed probiotics on the growth and survival of *L. vannamei*. Probiotic Pro-2 (selected *Bacillus* strains-concentration of bacteria: $2x10^{10}$ cfu/g bacterial growth media-Inve Company). Gut probiotic and immunostimulant 1, 3 β-Glucan, a commercial brand β-ADVANTAGE was applied in experimental ponds along with Pro-2. Feed probiotics help in release of digestive enzymes in the gut of the animals which enhance the metabolism and feeding rate. The feed probiotics help in the domination of useful microbial gut flora in the alimentary canal of the animals. The gut probiotics are live microorganisms applied as feed supplement with the motto of improving the health of the shrimp as reported by Tannock (1997). In the present study the growth and survival of the shrimps in experimental ponds showed better performance than control one during the study period. Management of good water quality is very much essential for optimal growth and survival of shrimps as reported by Soundarapandian *et al.,* (2010). Hence in this study we have maintained the optimal water quality levels throughout the study period in order to get better growth and survival rates.

CONFLICT OF INTEREST: The authors declare no conflict of interest.

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