International Journal of Entomology Research
www.entomologyjournals.com
ISSN: 2455-4758
Received: 17-08-2021, Accepted: 02-09-2021, Published: 18-09-2021
Volume 6, Issue 5, 2021, Page No. 89-92

Efficacy of probiotics on the growth and survival of *Litopenaeus vannamei* in the culture ponds of Karlapalem, Guntur district, Andhra Pradesh, India

Brahmam Pasumarthi[1*], Sunitha Peddapalli[2], Jayaprakash Ronanki[3], Gudabandi Vijaya Pratap[4]

[1] Associate Professor in Biology, Department of Humanities and Sciences, PACE Institute of Technology and Sciences, Ongole, Prakasam District, Andhra Pradesh, India

[2] Research Scholar, Department of Zoology, Osmania University, Hyderabad, Telangana, India

[3] Assistant Professor, Department of Zoology, Government Degree College, Pathapatnam, Srikakulam District, Andhra Pradesh, India

[4] Assistant Professor, Dr VS Krishna Government Degree and PG College (A), Visakhapatnam, Andhra Pradesh, India

Abstract
The purpose of the present study is aimed to estimate the efficacy of commercially available probiotics on the growth and survival of *Litopenaues vannamei*. For this study we have selected three ponds. One is treated as control, Pond-A and Pond-B treated as experimental. The study was conducted in commercial shrimp farms which are located in Karlapalem village, Guntur district, Andhra Pradesh, India. The study was carried out over a period of 120 days. Optimal water quality levels were maintained during the study period. It is evident from the results in summer crop of year 2019 that the survival rate of 74%, 83% and 87% was recorded for control, pond-A and pond-B respectively. For winter crop the survival rate of 73%, 80% and 85% was recorded for control, pond-A and pond-B respectively. Similarly in summer crop of year 2020 that the survival rate of 82%, 88% and 93% was recorded for control, pond-A and pond-B respectively. For winter crop the survival rate of 78%, 81% and 89% was recorded for control, pond-A and pond-B respectively. Overall pond-B showed good performance than pond-A and control.

Keywords: probiotics, survival rate, growth, *L. vannamei*

Introduction
The usage of probiotic in shrimp farming has been increased with the demand for eco-friendly aquaculture as reported by Wang *et al.*, 2005; Balcázar *et al.*, 2007; Kesarcodi-Watson *et al.*, 2008) [22, 1, 12]. The role of probiotics in disease control and usage of probiotics was described by Newaj-Fyzul *et al.*, (2014) [15]. Ferreira *et al.*, (2015) [7] reported about the microbial biofloc as a source of probiotic bacteria in *L. vannmei* farming. Kumar *et al.*, (2016) [13] provided information about the importance of probiotics in aquaculture, methods of application and mechanism of their action in the culture system. Hostins *et al.*, (2017) [11] evaluated the efficacy and differences in bacterial population densities in the gut of *L. vannamei.* Franco *et al.*, (2017) [8] also evaluated two important probiotics used in *L. vannamei* culture system. Chatla *et al.*, (2020) [2] depicted that shrimp farming gaining importance in recent days due to its taste, nutritional importance as well export value. Suneetha *et al.*, (2018) [18] stated that aquaculture is not only profitable sector but also provide nutritional diet to overcome poverty and malnutrition. Though the antibiotics have high efficiency towards disease prevalence but indiscriminate use of them is not acceptable. To overcome this problem probiotics has been introduced which will work effectively to control various microbiological diseases. Generally, the farm success rate is depending on the productivity. Hence in this study we have examined various commercially available probiotics on the growth and survival of shrimp *L. vannamei* from the Culture ponds of Karlapalem, Guntur district, Andhra Pradesh, India.

Materials and Methods
The present investigation was conducted in commercial shrimp farms which are located in the village of Karlapalem, Guntur District, Andhra Pradesh, India. In this study area we have selected three ponds for the experimentation. One treated as control, pond A and pond B were used as experimental ponds. The experiments were performed for two consecutive years i.e. 2019 and 2020 in both summer and winter seasons for four crops in the control and experimental ponds.

Pond Preparation
Before stocking, the selected ponds were re-excavated and allow them to sun dry to enhance the oxidation of H_2S and other obnoxious gases. The pH of the soil was tested with digital pH meter and the optimal pH was adjusted with the application of lime. The ponds were fenced with blue nets to prevent the entry of virus carrier species. The initial water level of the pond was maintained at 1.5 meters level. Later the optimal water levels were maintained during the culture period. Four paddle wheel aerators (2HP capacity) were installed in the four corners of the ponds. To enrich the plankton growth in the ponds the organic compounds, different minerals such as rice bran, fish meal, yeast, nutrilake, molasses and soda mix were added in the probiotics as well in control ponds.

Feeding procedure
For this study we have used C.P. semi-intensive feed (India Pvt Ltd). The feeding was performed as per the specification

given by the company. The same feed is used for two consecutive years in four crops both summer and winter. Feed intake was regularly monitored with check trays. The required amount of feed was calculated based on the check tray observation and body weight sampling. The amount of feed required for each pond was dispensed in 24 hours duration as follows: 25% at 6 am, 20% at 11 noon, 30% at 6 pm and 25% at 10 pm.

The Average Body Weight and Survival rate of the shrimp was estimated by adopting the following formulae

Average Body Weight (ABW)

Weight gain (%) = (Final weight-Initial weight)/Initial weight x 100

Survival Rate

Survival (%) = Nos. of animals survived/Nos. of animals stocked x 100

Results and Discussion

It is evident from the results in summer crop of year 2019 that the growth in grams of shrimp *L. vannamei* was noticed as 2.51±0.23 at 30 days of culture in control pond and this pond harvested due to white spot disease at 21.7 g on 105th day, where as in the experimental ponds such as pond A & pond B, the growth was 3.35±0.34, 3.53±0.39 respectively. Similarly, the highest growth in grams was noticed as 29.92±0.37 in pond B at 120 days of culture (Figure 1).

Similarly in the winter crop of year 2019 the growth in grams of shrimp *L. vannamei* at 30 days of culture in control pond was observed as 2.29 ± 0.27 and this pond was harvested due to white spot disease at 18 g on 96th day. Similarly, the growth in grams was 2.87±0.15 & 2.57±0.33 recorded in experimental pond A & pond B respectively. The highest growth in grams of 26.52±0.59 was observed in pond B at 120 days of culture (Figure 2).

In summer crop of year 2020, that the growth in grams of shrimp *L. vannamei* is 2.65 ± 0.15 was noticed at 30 days of culture in control pond, where as in the experimental ponds such as pond A & pond B, the growth was 3.63±0.32, 4.32±0.34 respectively. Similarly, the highest growth in grams was noticed as 33.38±0.57 in pond B at 120 days of culture (Figure 3).

In the winter crop of year 2020 the growth in grams of shrimp *L. vannamei* at 30 days of culture in control pond the growth in grams was observed as 2.55±0.34 and this pond is harvested at 6g on 66th day. The growth in grams was recorded as 3.27±0.46 & 3.20±0.35 in experimental pond A & pond B respectively. The highest growth in grams of 30.57±1.14 was observed in pond B at 120 days of culture (Figure 4).

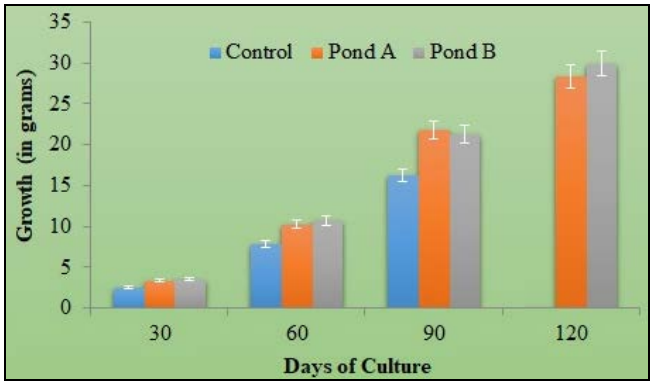

Fig 1: Growth of *Litopenaeus vannamei* (in grams) at Karlapalem in summer crop during the year 2019

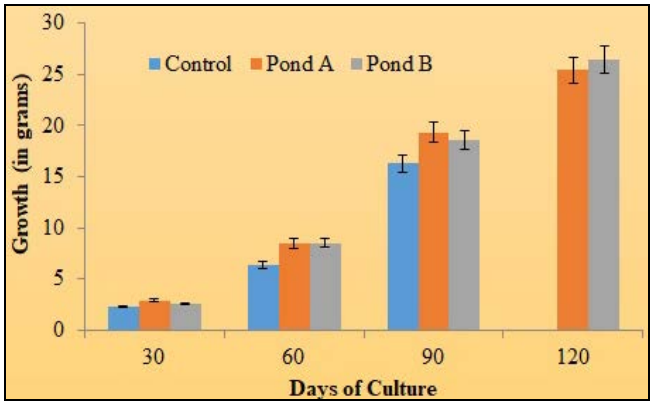

Fig 2: Growth of *Litopenaeus vannamei* (in grams) at Karlapalem in winter crop during the year 2019

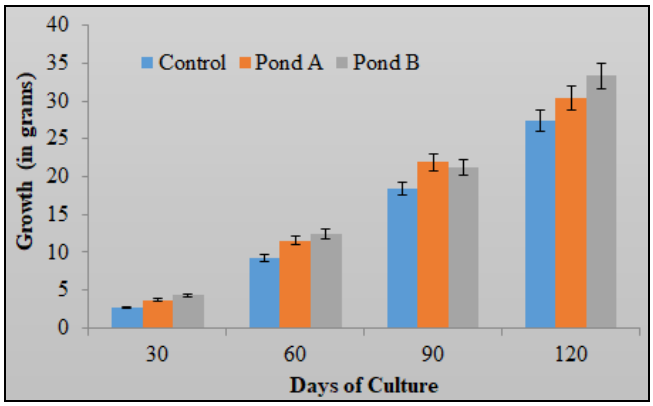

Fig 3: Growth of *Litopenaeus vannamei* (in grams) at Karlapalem in summer crop during the year 2020

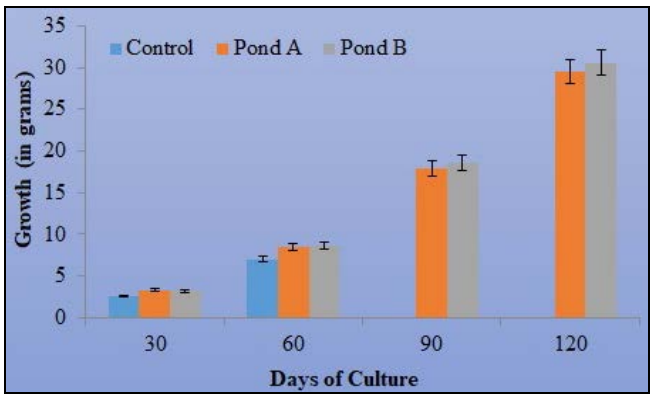

Fig 4: Growth of *Litopenaeus vannamei* (in grams) at Karlapalem in winter crop during the year 2020

Survival Rate

It is evident from the results in summer crop of year 2019 that the survival rate of 74%, 83% and 87% was recorded for control, pond-A and pond-B respectively. For winter crop the survival rate of 73%, 80% and 85% was recorded for control, pond-A and pond-B respectively. Similarly in summer crop of year 2020 that the survival rate of 82%, 88% and 93% was recorded for control, pond-A and pond-B respectively. For winter crop the survival rate of 78%, 81% and 89% was recorded for control, pond-A and pond-B respectively.

According to Chiu *et al.*, (2007) [3] the total mortality rate of white shrimp was decreased when the shrimp fed with a supplemented feed of 1010 cfu/kg of *Lactobacillus plantarum* after infection with *V. alginolyticus.* In another study with *L. vannamei* fed with two potential probiotics

such as strain C2 and B6 achieved better survival rate of 44% and 50% than control group of 21%. This phenomenon observed in mysis 3 stage to PL-1, after infection with *V. harveyi* as reported by Viera *et al.,* (2007) [19]. According to Deeseenthm *et al.,* (2007) [5] morphometric changes were observed in *Macrobrachium rosenbergii* when fed with probiotics. In another study conducted by Rengpipat *et al.,* (1998; 2003) [16, 17] revealed that significant changes in the body of *P. monodon* were noticed in probiotic fed group of shrimps. Similar results were also obtained in *L. vannamei* by (Gomez and Shen, 2008; Gullian *et al.,* 2004; Wang and Gu, 2010; Wang, 2007; Zokaeifar *et al.,* 2012) [9, 10, 20, 21, 23] in *M. japonicus*, by Dong *et al.,* (2013) [6] in *M. rosenbergii* by Mujeeb Rahiman *et al.,* (2010) [14] in *F. brasiliensis* (De Souza *et al.,* 2012) [4]. Similarly in the present study, we have noticed significant changes in the growth and survival rates of *L. vannamei* in probiotics treated ponds (experimental ponds). It is also evident from the present results that, the probiotics treated ponds showed better performance and tolerated for various microbial diseases.

Recommendations

Application of probiotics in the culture ponds of shrimps have shown promising results in terms of better growth, survival and disease resistance. Farmers are encouraged to use various brands of probiotics instead antibiotics to fight against different diseases.

Conflicts of Interest

The authors declare no conflicts of interest.

References

1. Balcázar JL, De Blas I, Ruiz-Zarzuela I, Vendrell D, Gironés O, Muzquiz JL. Enhancement of the immune response and protection induced by probiotic lactic acid bacteria against furunculosis in rainbow trout (*Oncorhynchus mykiss*). FEMS Immunology and Medical Microbiology,2007:51(1):185-193.
2. Chatla D, Padmavathi P, Srinu G. Wastewater treatment techniques for sustainable aquaculture. Waste Management as Economic Industry towards Circular Economy. Springer, Singapore, 2020, 159-166.
3. Chiu CH, Guu YK, Liu CH, Pan TM, Cheng W. Immune responses and gene expression in white shrimp, *Litopenaeus vannamei*, induced by *Lactobacillus plantarum*. Fish and Shellfish Immunology,2007:23:364-377.
4. De Souza DM, Suita SM, Leite FPL, Romano LA, Wasielesky W, Ballester ELC. The use of probiotics during the nursery rearing of the pink shrimp *Farfantepenaeus brasiliensis* (Latreille, 1817) in a zero exchange system. Aquaculture Research, 2012:43(12):1828-1837.
5. Deeseenthum S, Leelavatcharamas V, Brookes JD. Effect of feeding *Bacillus* sp. as probiotic bacteria on growth of giant freshwater prawn (*Macrobrachium rosenbergii* de Man). Pakistan Journal of Biological Sciences: PJBS,2007:10(9):1481-1485.
6. Dong HB, Su YQ, Mao Y, You XX, Ding SX, Wang J. Dietary supplementation with *Bacillus* can improve the growth and survival of the Kuruma shrimp *Marsupenaeus japonicus* in high-temperature environments. Aquaculture International, 2013, 1-11.
7. Ferreira GS, Bolívar NC, Pereira SA, Guertler C, do Nascimento Vieira F, Mouriño JLP *et al*. Microbial biofloc as source of probiotic bacteria for the culture of *Litopenaeus vannamei*. Aquaculture,2015:448:273-279.
8. Franco R, Martín L, Arenal A, Santiesteban D, Sotolongo J, Cabrera H *et al*. Evaluation of two probiotics used during farm production of white shrimp *Litopenaeus vannamei* (Crustacea: Decapoda). Aquaculture research,2017:48(4):1936-1950.
9. Gómez RGD, Shen MA. Influence of probiotics on the growth and digestive enzyme activity of white Pacific shrimp (*Litopenaeus vannamei*). Journal of Ocean University of China,2008:7(2):215-218.
10. Gullian M, Thompson F, Rodriguez J. Selection of probiotic bacteria and study of their immunostimulatory effect in *Penaeus vannamei*. Aquaculture,2004:233:1-14.
11. Hostins B, Lara G, Decamp O, Cesar DE, Wasielesky JW. Efficacy and variations in bacterial density in the gut of *Litopenaeus vannamei* reared in a BFT system and in clear water supplemented with a commercial probiotic mixture. Aquaculture,2017:480:58-64.
12. Kesarcodi-Watson A, Kaspar H, Lategan MJ, Gibson L. Probiotics in aquaculture: the need, principles and mechanisms of action and screening processes. Aquaculture,2008:274(1):1-14.
13. Kumar V, Roy S, Meena DK, Sarkar UK. Application of probiotics in shrimp aquaculture: importance, mechanisms of action, and methods of administration. Reviews in Fisheries Science and Aquaculture, 2016:24(4):342-368.
14. Mujeeb Rahiman KM, Jesmi Y, Thomas AP, Mohamed Hatha AA. Probiotic effect of Bacillus NL110 and Vibrio NE17 on the survival, growth performance and immune response of *Macrobrachium rosenbergii* (de Man). Aquaculture Research,2010:41(9):e120-e134.
15. Newaj-Fyzul A, Al-Harbi AH, Austin B. Developments in the use of probiotics for disease control in aquaculture. Aquaculture,2014:431:1-11.
16. Rengpipat S, Phianphak W, Piyatiratitivorakul S, Menasveta P. Effects of a probiotic bacterium on black tiger shrimp *Penaeus monodon* survival and growth. Aquaculture,1998:167(3-4):301-313.
17. Rengpipat S, Tunyanun A, Fast AW, Piyatiratitivorakul S, Menasveta P. Enhanced growth and resistance to Vibrio challenge in pond-reared black tiger shrimp *Penaeus monodon* fed a Bacillus probiotic. Diseases of Aquatic Organisms,2003:55(2):169-173.
18. Suneetha K, Darwin CH, Kavitha K. Biofloc Technology: An emerging tool for sustainable aquaculture. International Journal of Zoology Studies,2018:3(1):87-90.
19. Vieira FDN, Pedrotti FS, Buglione Neto CC, Mouriño JLP, Beltrame E, Martins ML *et al*. Lactic-acid bacteria increase the survival of marine shrimp, *Litopenaeus vannamei*, after infection with *Vibrio harveyi.* Brazilian Journal of Oceanography,2007:55:251-255.
20. Wang Y, Gu Q. Effect of probiotics on white shrimp (*Penaeus vannamei*) growth performance and immune response. Marine Biology Research,2010:6(3):327-332.
21. Wang YB. Effect of probiotics on growth performance and digestive enzyme activity of the shrimp *Penaeus vannamei*. Aquaculture,2007:269(1-4):259-264.
22. Wang YB, Xu ZR, Xia MS. The effectiveness of commercial probiotics in northern white shrimp

Penaeus vannamei ponds. Fisheries Science, 2005:71(5):1036-1041.
23. Zokaeifar H, Balcázar JL, Saad CR, Kamarudin MS, Sijam K, Arshad A *et al*. Effects of *Bacillus subtilis* on the growth performance, digestive enzymes, immune gene expression and disease resistance of white shrimp, *Litopenaeus vannamei.* Fish and shellfish Immunology, 2012:33(4):683-689.