ISSN 2348-313X (Print)
International Journal of Life Sciences Research ISSN 2348-3148 (online)
Vol. 7, Issue 1, pp: (193-196), Month: January - March 2019, Available at: www.researchpublish.com

Isolation and characterization of bacterial flora from different shrimp pond soil ecosystem

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Abstract: **Marine shrimp farmers generally believe that bottom soil quality in ponds deteriorates over time because of sediment accumulation, declining pH, and increasing organic matter concentration. Pond bottom soil management has received much attention in marine shrimp culture. Totally 9 different soil samples were collected from shrimp culture farm at Nagapattinam district, Tamilnadu and their physico-chemical properties were analyzed. Our research goal was to determine the prevalence, properties, persistence, and types of bacteria in shrimp aquaculture. In the present investigation the *Lactobacillus* sp. 2.33 x 10^{-6} - 2.88 x 10^{-6} CFU/ml occupied dominant role.**

Keywords: **Shrimp, Aquaculture, Pond, *Penaeus vannamei* , *Lactobacillus.***

I. INTRODUCTION

Aquaculture is the farming of aquatic organisms by intervention in the rearing process to enhance production. This activity allows a selective increase in the production of the species used for human consumption to overcome malnutrition and also to attain good economic growth.

Shrimps are highly priced seafood harvested from coastal tropical and warm-temperature waters throughout the world. Shrimps support commercially valuable fisheries in many areas of the world (Ajani *et al*., 2013). In recent decades, because of the high demand for shrimps, shrimp aquaculture has expanded rapidly in all around the world (Lombardi *et al*.,2006).

Penaeus vannamei is a prominent marine shrimp with high economic value in Southeast Asia. Commercial production of the shrimp has been in a major decline due to higher incidents of viral and bacterial disease outbreaks .

The physico-chemical factors of the culture pond and their individual or synergetic effects play an important role on shrimp production and pond ecology. The ecosystem and biota of the culture ponds may also influence the production performance of shrimp culture. Studies suggested that the growth and survival of shrimps are affected by temperature, salinity and dissolved oxygen concentration (Subrahmanyam, 1973; Verghese *et al.*,1975 and 1982 ; Liao, 1977).

Recent development in aquaculture science has improved vastly in certain areas of tiger shrimp production but the results still remain inconsistent. In this context, an investigation was undertaken to isolate native microbial flora and observe the ecological factors with the growth of *P. vannami* in the culture pond ecosystem near Bay of Bengal costal line of Nagappatinam, Tamilnadu. Among the total isolates the active cultures will be segregated and were characterized with traditional method.

II. TERIALS AND METHODS

Systemic Classification:

Phylum : Arthropoda

Subphylum : Crustaceae

Class : Malacostraca

Order : Decapoda

Family : Penaeidae

Genus : *Penaeus*

Species : *vannamei*

Collection of soil sample:

Total 9 different intensive *P. vannamei* culture ponds have been selected from Thirupoondi village at Nagapattinam district, Tamilnadu.

Soil samples (5-cm-diameter cores) were collected at a depth of 15 cm from three places in the bottom of each pond immediately following draining for harvest (but before applying bottom treatments) and at the end of the 35-d dry-out period. All samples were analyzed for pH, bulk density, texture, electrical conductivity, organic carbon, available nitrogen, available potassium and available phosphorus (Table 1). Samples taken at the end of the dry-out period also were analyzed for soil moisture (Gardner, 1986) and total bacterial plate count (Germida and de Freitas, 2008).

Media and techniques for isolation and enumeration of bacteria:

Media used for the isolation and enumeration of bacteria in Zobell marine agar medium. The different techniques were applied for the isolation and enumeration of bacteria: dilution plate was carried out 10^{-6} and spread plate methods (Sanders,2012). The inoculated media were incubated at 37°C for 24 to 48 hours.

Enumeration of bacteria:

After incubation, the plates having well-spaced colonies were selected for counting. The selected plates were placed on a colony counter (Stuart Scientific U K) and the colonies were counted. The colonies or viable bacterial count per ml were calculated by multiplying the average number of colonies per plate by reciprocal of the dilution. The calculated results would be as colony forming units (cfu) per ml of sample.

Chemical analysis:

The soil samples were analyzed of selected chemical properties. Soil pH was taken using a pH probe, bulk density, texture, electrical conductivity and organic carbon (%) was measured by digestion of the soil samples with dichromate solution following the procedures described by Walkley and Black (1934). Available Phosphorus content (mg per liter, ppm) was analyzed using the procedures of Bray Method (Bray and Kutz,1945). Available Nitrogen was estimated by Alkaline permanganate Method (Subbiah and Asija,1956), Available Potassium content in the extract was determined by using Flame photometer (Standfold and English,1949).

III. RESULT AND DISCUSSION

The physico-chemical properties of these experimental ponds were shown in Table 1. pH level was found to be in range of 7 to 8.5. Due to this, it was found that metabolism and other physiological process of shrimp have been done properly. In addition to this, ecology of pond has also been balanced. The range of 7 to 8.5 pH found to be the best for growth and optimum feed efficiency.

The results clearly display that the pH ranged from 7.8-9. Which was reported as the recommended level of pH (Massuda and Boyd ,1994) of sediment pond soil. The amount of organic carbon range was found 0.63-0.87%. The concentration of organic carbon in the present study was used supplementary feeds in the ponds which remain unused and deposited on the soil bottom.

The optimum range of salinity for shrimp farming 5-30 ppt (Mazid, 2009 and DoF, 2009). The finding of the present study (3.5-5.7 ppt) was more or less similar to the recommended salinity level in shrimp farming. Shrimp farm soil samples were collected and these soils were categorized as sandy clay loam, clay and sandy loam. Out of 6 soil samples 4 fall in clay, 1 in sandy loam and 1 in sandy clay loam categories and bulk density (g/cm^3) of soil range from 1.150 – 1.400 as given in Table-1. Water holding capacity of soil samples ranges from 23-30% respectively. Similar results were reported (Tanveera *et al*., 2016). Electrical conductivity (dsm^{-1}) of shrimp farm soil samples were ranged from (0.4-0.7).

The available copper content of soil ranged from 1.14-2.25%, Available Zn content ranged from 1.50-2.50 %, Available Mn content ranged from 2.50-4.95% and Available Fe content ranged from 5.10-8.25% similar results were reported by Lindsay and Norvell,1978.

Available Nitrogen is present mostly in organic forms which are broken down through bacterial action into simpler inorganic molecules. The available nitrogen content of shrimp pond soil was recorded (1.50-1.85%). The availability of phosphorus is the most important to aquatic productivity owing to the fact that PO_4 ion in soil from insoluble compound with iron and alumina under acidic condition and with calcium under alkaline condition. In the present study availability of phosphrous ranged from 0.140-1.790%. Generally, potassium is need relatively in small amount for shrimp pond. The potassium value of shrimp pond soil was recorded (1.35-1.85%). Smith 1946) reported available macronutrients results of pond soil. The results of bacterial growth in Zobell Marine Agar media were given in the Table.2. The *Lactobacillus* sp. 2.33×10^{-6} - 2.88×10^{-6} CFU/ml occupied dominant role.

IV. CONCLUSION

The results showed that, sustainable aquaculture development can bring real and lasting benefits for aqua farmers and dependent communities. But the environmental consequences of inappropriate or excessive development will adversely impact on the wider communities and the farms themselves through poor farm performance. Therefore an increasing need for good planning and management of aquaculture in our countries.

In the above discussion it has shown that all parameters of soil such as texture, pH, alkalinity, organic carbon and organic matter more or less similar to the standard level of aquaculture activity. It may be concluded that if proper management strategies can be developed then the aquaculture will be successfully developed in that Nagapattinam area.

ACKNOWLEDGEMENT

The authors are grateful to the Secretary, Correspondent and Principal of A.V.V.M. Sri Pushpam College (Autonomous) Poondi, for providing laboratory facilities.

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