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Probiotics: A Promoter for Aqua Farming

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Introduction

Traditional approach of using antibiotics in aquaculture industry for disease control leads to the generation of antibiotic resistant microorganisms [1]. Also, there is a threat associated with spread of antimicrobial resistant gene from aquatic environment to human pathogens [2]. Alternative approach for controlling of pathogen instead of using antibiotics involves use of probiotics for modification of gut flora, which is supplemented through diet and thus increases the amount of health promoting bacterial in the gut [3].

In order to ensure aquaculture production, Probiotic treatment becomes a better of way in terms of disease control and prevention [4]. Probiotics are defined as living micro-organisms administered in a sufficient number to survive in the intestinal ecosystem and they must have a positive effect on the host [5]. There are certain demands for a micro-organism to become a probiotic. Providing a definition for a probiotics in aquaculture industry is a bit difficult and challenging too. But most accepted definition given by (FAO/ WHO, 2002) [6]. According to it, Probiotics are defined as,

"Live micro-organisms which when administered in adequate amount confer a health benefit on the host".

Their benefits to aquatic organism's health have been mentioned in many scientific research papers [7-9]. As per Council Directive 70/524/EEC these bacterial strains (Probiotics) are certified as additives in their feeding stuff [10].

Bacillus cereus var.toyoi, Bacillus licheniformis, Bacillus subtilis, Lactobacillus sp., Enteroccocus faecium, Lactobacillus casei, Lactobacillus farciminis, Lactobacillus plantarum, Lactobacillus rhamnosus, Pediococcus acidilactici, Streptococcus infantarius, Carnobacterium sp., and yeast Saccharomyces cerevesia also.

The aim of this article is to demonstrate probiotic selection aspects, mode of action, guidelines for evaluation process, and their respective roles in shrimp nutrition.

Selection aspects of a probiotic

The critical concept behind the choosing of a microorganism as a probiotic is selection process because undesirable effects may occur in the host due to inappropriate choice of a probiotic [11]. The selection of a microorganism as a probiotic requires various selective aspects such as 1) Basic aspects 2) Technological aspects 3) Biosafety aspects [12-17].

Modes of action

The mechanism of interaction between bacteria and host remains undefined but the evidences suggest that the functioning of the immune system at both systemic and mucosal level in the gut can be modulated by the bacteria [18].

According to Oelschlaeger in 2009, he stated that a probiotic can exert its effects in three modes of action:

1) A probiotic can be able to influence host immune defence system, which involves both innate as well as acquired immune system.

2) A probiotic must show its action on the other microorganisms, which comprises of both commensal as well as pathogenic ones.

3) Lastly, a probiotic might be capable of displaying its action on microbial products like toxins and host products [19].

A Probiotic exercises their beneficial effects by mean of any of the following: [20-26] (Figure 1).

Guidelines for evaluating a probiotic - An outline

For the use of a given microorganism as a probiotic and its practice in shrimp aqua- farming, the microorganism has to be evaluated as per the given procedure in Figure 2. Once the organism is successfully evaluated as a probiotic it can be safely applied.

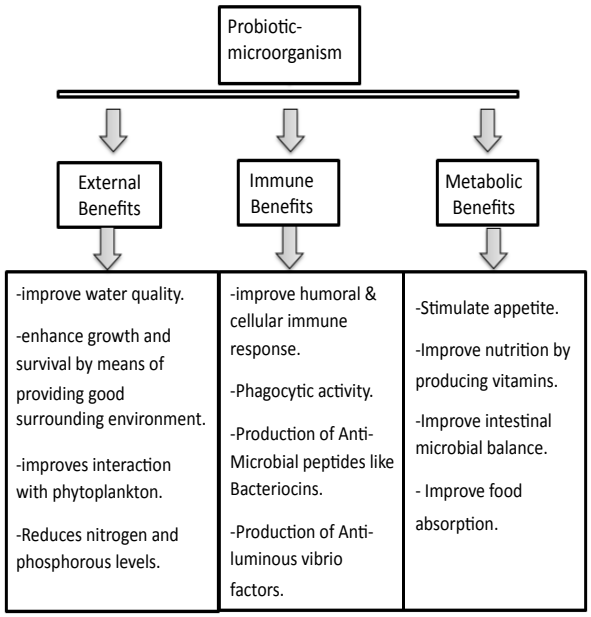

Figure 1: Guidelines for evaluating a probiotic - An outline.

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Uniqueness of the Probiotic	Method of use/species	Major outcomes	References
Arthrobacter XE-7	Nurtured with water (Penaeuschinensis post larvae)	Increased resistance to pathogenicvibrios(V. parahaemolyticus, V.anguillarum and V. nereis) -Improved water quality	[28]
Bacillus spp.	Through Feed (Prawns)	*Bacillusspp able to eliminate luminous vibrio spp.in the mid gut of shrimp -Act as an inhibitor for Aeromonas hydrophiliaWS1*	[29]
Bacillus vallismortis W120	Through Feed (Branchinellathailandensis)	Stimulated Phagocytic E7; Enhanced both cellular and humoral immune defences; -Better survival rate;-Better growth performance;	[30]
Pediococcusacidilactic ((strain MA 18/5M, CNCM)	Through Feed or as water additive. (Litopenaeusstylirostris)	Increased its resistance to Vibrio alginolyticus infection. Boosted immune ability	[32]
Pseudomonas aeruginosa (strainYC5-8).	Mixed the both strains and employed it to culture water (Litopenaeusvannamei)	showing improved survival rate when challenging with pathogens(Vibrio harveyi and V. parahaemolyticus)	[33]
Burkholderiacepacia (strain Y02-1).	Through Feed (Litopenaeusvannamei)	Improved water quality parameters. Improved growth performance and Survival. Improved disease resistance against vibrios.	[34]
Streptococcus phocaePI80 and Enterococcus faeciumMC13	Through Feed (Penaeusmonodon Post larvae)	Immune enhancement. Water quality improvement. Improve nutrient digestibility.	[35]
Streptomyces	Applied through feed (Penaeusmonodon (Fabricius))		[36]
Vibrio NE17 and Bacillus NL110	Applied through feed,water and both (Macrobrachium Rosenbergii)		[37]

Table 2: Probiotics used in shrimp nutrition and their respective outcomes.

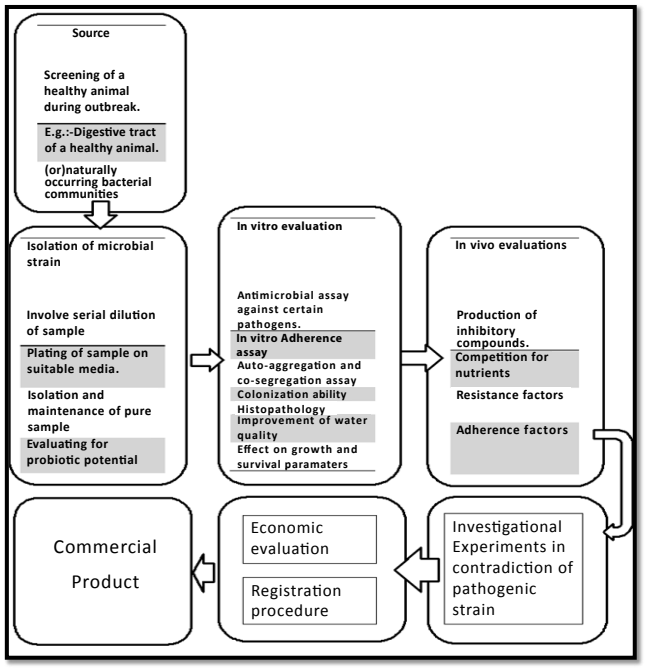

Figure 2: Probiotic evaluation chart for shrimp aqua farming.

Basic aspects	- It should be non-pathogenic. - It has to produce inhibitory compounds - It has to show antagonistic activity against certain pathogenic microorganisms - Competitive exclusion of binding sites, - it has to compete for nutrients - stimulates mucosal immunity. - it must have the ability to colonize and prevent the establishment of potential pathogenic microorganism
Technological aspects	It has to show resistance towards phage,sensory properties, Inconsistency during Processing, constancy during Production and storage,It must be free of Plasmid Programmed Antibiotic resistance Genes.
Biosafety aspects	- The way they produced and processed. - Route of incorporation of probiotic - Expected site of activity of microbe in body

Table 1: Outlines of the research based evidences, suggesting about their health benefits in the aquatic environment as well as host benefits.

Probiotic benefits in shrimp nutrition

There is always a complex interaction existing between host in aquatic environment and environment & vice-versa [27]. Probiotics can influence health benefits in variety of ways. The Table 1 outlines the research based evidences, suggesting about their health benefits in the aquatic environment as well as host benefits.

Conclusion

Probiotics has opened a new era in disease control, instead of the regular antimicrobial exercise in aquaculture. Research has actively shown in reports that a probiotic micro-organism can safely encourage considerable well-being benefits like immunity enhancement, increased disease resistant, and they can also improve nutrient digestion ability [31].

Probiotics present an exciting promise for significantly reducing the load of pathogenic microorganisms (especially luminous *Vibrio harveyi*). But at this time no microorganism can be confidently suggested to shrimp's cultivation (Table 2). But positive outcomes are clearly exhibited with certain commercial products. Future research is needed in terms of scientific based exploration and a proper safety evaluation. Risk assessment based studies are also needed in this essential field.

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