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ORIGINAL ARTICLE

Effect of Sugarcane Bagasse with *Bacillus* on Growth and Biochemical Changes of Fish *Etroplus suratensis*

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ABSTRACT
One of the major constraints in the aquaculture industry all over the world is disease outbreak. In order to avoid all the problems scientist have selected certain beneficial microbes, so called probiotics which can be used as feed additives. The genus Bacillus contain some of the bacteria used as probiotics by the aquaculture industry and are able to secrete many exo enzymes, that improve food digestion and absorption and also improve water quality. The main problem faced by the aquaculture farmers were, the less availability of natural fish feed. The synthetic feeds are costly so it affects the small range production of aquaculture. So a new approach will be needed, it must be low cost and organic, so the agricultural waste was taken as the main compound for the feed with other appropriate ingredients also. Bagasse is the fibrous residue remaining after the juice has been extracted from sugarcane which is also used as an alternative food additive so as to enhance its nutritional properties. The effect of natural feed ingredients and a mixture of fish gut probiotic bacterial flora Bacillus on the growth response of Etroplus suratensis higher than control diet was analyzed in this work.
Keywords: Probiotics, *Bacillus*, Sugarcane bagasse, *Etroplus suratensis*

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INTRODUCTION

Successful and sustainable culture of finfish and shellfish depends on the use of nutritionally balanced, low-cost and eco friendly feeds[1]. Feed constitutes more than 50% of the operating expenditure in aquaculture. In aquaculture practices, probiotics are used for a quite long time but in last few years, probiotics became an integral part of the culture practices for improving growth and disease resistance[2]. Probiotics are 'a live microbial feed supplement which beneficially affects the host animals by improving its intestinal microbial balance[3]. Most probiotics have the capability to produce substances which have direct antimicrobial action[4]. Probiotics are natural supporting substances in the feed and the host has many advantages also[5]. The advantages of such supporting substances were enhanced feed rate, improve the digestion, resist the action of dangerous pathogens, anti mutagenic and anti carcinogenic effect, growth supporting compounds and amplify the immunity[6] .

Nowadays the amounts of the farming waste are high. Actually these are not waste materials they are waste resources, as they have great source of nutrients[7]. The agricultural waste sugarcane bagasse is grouped under carbohydrate, protein, mineral and cellulose rich materials. Efficient and judicious utilization of these waste materials as a feed ingredient in aqua feed through microbial technology certainly pave the way for better management of these waste materials; which in turn reduce the pollution menace due to the disposal of these waste materials[8]. From the agricultural research,

sugarcane residue was explored for their practical use as a partial substitution in a food product[9]. The *Trichodertma viride* was similarly used on sugarcane bagasse, to develop the digestion[10].
The main aim of this work to test the efficiency of the probiotic and feed additive added diets on growth responses, biochemical composition and bacterial diversity in GI tract of experimental fish [11,12].

MATERIAL AND METHODS

A healthy *E. suratensis* was collected from the place Rajakkamangalam, Kanyakumari district, Tamilnadu. The collected marine samples (fish) were kept in the laboratory and maintained the temperature and pH up to 2 days. The main feed on the fish was freshly made pellet diets and 50% water exchange was given daily. The fish feed contain all types of minerals, proteins, essential oil etc. The extra probiotics were also added to the diet, the *Bacillus* was used as probiotic for good digestion. The details of feed components are mentioned in Table 1. Based on the square method (New, 1987), the feed composition was done. In this study we were following 2 types of diet formulations (diet A and diet B). The diet A contain around 50% of protein with 2% pulpy residue of sugarcane and remaining are other ingredients. The diet B include 2% of CMC with other ingredients. The probiotics *Bacillus* was consider as an additive in both diets and the control was prepared without probiotics. For this study we conducted 2 sets of experiment and by using large volume of tanks with 30 liter of water, each tank contained six number of fishes. For the fishes the feed on demand was followed and almost 3 times per day the fishes wear fed. During the experiment the quality and desirable conditions of the water was also maintained.

Table 1: Percentage composition of ingredients of dietA and dietB (g/100g)

Feed ingredients	**DietA**	**DietB**
Fishmeal	33.09	33.09
peanut oilcake	30.05	30.05
Soyameal flour	20.01	20.01
Wheatflour	5.65	5.65
Byproduct of the rice milling	4.29	4.29
Cassava powder	3.05	3.05
Vitamins and minerals	0.52	0.52
Fish oil	1.55	1.55
Food suppliment	2.03	2.03
Probiotic	1.01	-

RESULTS

Growth Response

The fishes were fed with diet A, they expressed great growth (26.70±0.18) when compared with the fishes treated with diet B. The FCE and FCR were much better in diet A than diet B. The growth rate of fishes with both the diets were mentioned in Table 2.

Table 2: Growth rate of *E. suratensis* (3 months of feeding)

Factors	**Growth rate**	
	dietA	**dietB**
Initial weight (g)	16.00±0.70	16.00±0.20
Final weight (g)	26.70±0.18	24.00±0.90
Production (g)	11.20±0.35	10.80±0.36
Consumption of food (g)	30.13±0.45	38.62±0.86
FCE (%)	33.85±0.45	27.96±0.65
SGR (%)	0.57±0.72	0.59±0.32
FCR	2.90 ± 0.24^{ab}	3.53 ± 0.23^{a}

Analysis of Biochemical factors

The biochemical factors mostly depends on the presence of probiotics and different types of additives. The biochemical properties were higher in diet A than diet B, because the diet A contains different types of proteins, vitamins and other important ingredients. The separate list of biochemical composition for both diets is mentioned in Table 3.

Table 3: Biochemical composition of muscle, gill and gut samples of *E.suratensis* fed on dietA and dietB

Biochemical composition	**muscle**		**gill**		**Gut**	
	dietA	**dietB**	**dietA**	**dietB**	**dietA**	**dietB**
Protein	35.14±0.15	33.46±0.20	29.15±0.13	27.15±0.12	25.20±0.12	23.36±0.14
Carbohydrate	3.09±0.01	3.06±0.01	2.05±0.01	2.00±0.01	2.10±0.01	2.25±0..01
lipid	2.23±0.01	2.86±0.02	1.96±0.01	2.08±0.12	1.70±0.01	1.82±00.011

Gut microbial analysis

The diet A revealed higher bacterial growth in 3 months of experimental period. The diet A contains probiotics and sugarcane. The diet A followed fishes had more microbial population than the B diet consumed fishes (Fig 1).

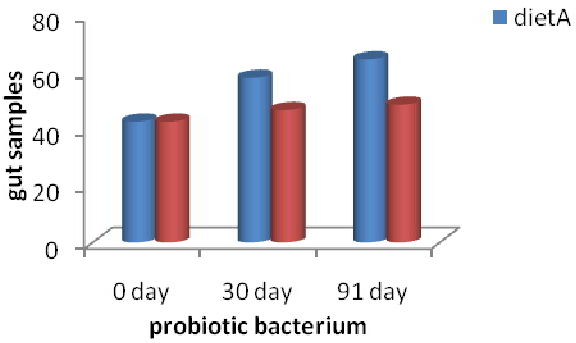

Figure 1: The formulation in digestive part of diet A and diet B

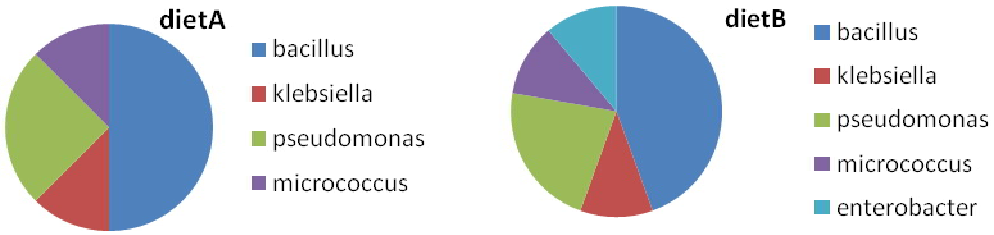

Fig 2: The microbiome in the digestive part of the experimental fish differs with the ingredients of the corresponding diets and also the time duration of the experiment (Fig 2).

DISCUSSION

The probiotics have the ability to live on and develop at the site of application while applying their valuable properties. Nowadays the need of natural/organic way of aquaculture was increased, for this practice the probiotics can be considered as an immunostimulator. By using probiotic in the aquaculture, it helps to develop more stable immunity having fishes and also free from different pathogens. The growth rate also increased when we use probiotics in the aquaculture. In the present study probiotic bacterium *Bacillus* was isolated from the gut of fish *E. suratensis*. The higher level of enzyme activity obtained with diets containing probiotics, improved the digestion of protein, starch, fat and cellulase; which is an important factor in realizing better growth performance in probiotic supplemented diets. Similar effects have been reported for fish and shrimp, that the digestion was shown to increase considerably with the response to probiotics in the diet

In recent years, much work has been carried out towards efficient utilization of agro-industrial residues such as wheat bran, sugarcane bagasse, coconut coir pith and others.The feed of the animals can be synthesized from agricultural waste, the recycled food waste and animal wastes, they were all natural and organic. The overall results indicated the fact that the better growth recorded in experimental fish *E. suratensis* fed with sugarcane bagasse powder. studied the influence of the addition of a mutant strain of *Trichoderma viride* on sugarcane bagasse, to improve the digestion of the same through the cellulase enzyme system.The study by Sogaard and Jessen (1990) explained that the use of probiotics especially *Bacillus* species developed microbial changes in the digestive system. These changes may lead to the increase of the concentration of *Lactobacillus* and improve the ability to resist infections. The concentration of *E. coli* was decreased and organic acids quantity was improved. These changes are also seen in the experimental animals, that consume the diet A, the diet is a combination of probiotics and sugarcane bagasse addictives, the diet was followed up to 3 months.

Commonly the probiotics are usual intestinal bacteria, it developed in the digestive system and helps in the digestion process, most of the probiotics are good for human health with desirable dosage. Several studies have shown that the introduction of *Bacillus* species cause changes in the internal bacterial microflora composition. This present study has shown that the introduction of *Bacillus* species cause changes in the internal bacterial microflora composition. In conclusion, the present results elucidated that the probiotic *Bacillus* and sugarcane bagasse enhanced the growth performance and biochemical composition in fish *E. suratensis*.

CONCLUSION

The current study focused on the use of agricultural waste and probiotics in the feed of aqua animals and how the feed support their growth and immunity. The results of this study were really helpful for the aquaculture in large scale with desired environmental factors. Here we have also checked the changes of *Etroplus suratensis* fish only. This study results can be used for the production of other fishes also.

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