Studies on Marine Streptomycetes Associated with Seaweeds and Their Application as Single Cell Protein for Growth of the Juvenile Fish, *Brachydanio rario*

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Abstract

The present investigation was an attempt to understand the distribution pattern of Streptomycetes in the five selected sea weed collected from Kovalam coast and the effect of isolated Streptomycetes as Single Cell Protein that has been incorporated into the artificial feed on growth of juveniles of Brachydanio rario. Food conversion efficiency and food conversion ratio were determined. From the experiment it is clear that microbial Single Cell Protein can be used to replace the fishmeal to certain extent in the artificial feeds.

Keywords: Marine streptomycetes, Seaweeds, Single cell protein, Growth, Fish, *Brachydanio rario*

Introduction

In India the commonly found seaweeds are *Gracillaria, Ulva, Sargassum,* and *Chaetomorpha* (Chapman, 1970). Streptomycetes are found to be the most predominant group of actinomycetes. The genus Stretomycetes was proposed by Waksman and Henrici (1943).Streptomycetes are useful for the production of antibiotics and also for the synthesis of growth promoting hormone indole acetic acid (Dhevendaran and Anithakumari ,2000) In aquaculture, supplementary feeding is a major expense.Essential and expensive components of the fish feed are the protein. Microbial biomass is rich in protein. Streptomycetes serves as a Single Cell Protein and replace 25-50% of fish meal. Streptomycetes produce some secondary metabolites, which may enhance the growth of fish (Rainbow and Rose, 1963).

Materials and Methods

Five seaweeds were collected from Kovalam coast. They are *Gracillaria corticata, Sargasum wightii, Caulerpa racemosa, Ulva fasicata and Chaetomorpha antennina.* 1gm basal portion of each seaweed was weighed, homogenized and transferred into 99ml blank prepared with 100% sea water (10^{-2} dilution). 1ml aliquot of 10^{-2} dilution was pipetted out into three sterile petriplates. 20ml of specific media like Kuster's agar medium, Actinomycetes agar medium and Glycerol Asparagine agar medium was poured into the petriplates. The plates were then incubated in an inverted position at room temperature till the appearance of colonies. For mass culture the isolated Streptomycetes were inoculated into the actinomyces broth and incubated for 10 days at room temperature. From the mass culture suspension Streptomycetes were obtained by filtration. It was dried in an oven and pulverized. Feeds were formulated using square method (Hardy,1980).Three types of feeds were prepared using finely powdered ingredients like ground nut oil cake, rice bran, bengal gram powder, fishmeal and Streptomycetes. The ingredients were mixed thoroughly with small quantity of water, in order to obtain smooth dough. Then it was cooked in a domestic pressure cooker for about 30 minutes. It was allowed to cool and extruded through a pelletizer. Then the pellets were dried in an oven. The protein content of the ingredients used for preparing artificial diet was estimated by Lowry's method (Lowry and Rieman, 1951). The feed compositions were: D1 = Control feed containing fish meal (without Streptomycetes), D2 = Feed containing Streptomycetes and D3 = Feed containing Streptomycetes and fishmeal.

For this study fingerlings of fresh water fish *Brachydanio rario* was selected with approximately 1g weight. For each type of feed one trough with 50L of fresh water was taken and five fishes were kept in each trough. The fishes were fed at the rate of 5% of the body weight once daily for 15 days. About 75%of the water from each trough was changed daily with minimum disturbance to the fish. The unconsumed feed and faecal matter were collected and dried at 60^0C in an oven and weight was recorded.

The weight of the fishes was recorded on 15^{th} day of the experiment. Feed intake, conversion ratio and conversion efficiency were calculated using following formulas: Feed intake = Dry weight of the feed given - Dry weight of the left over feed, Food conversion ratio = Food intake/Weight gain, Food conversion efficiency = Weight gain/Food intake x 100.

Results

Total microbial population of five selected seaweed were given in (Table-1). Among the five seaweeds, maximum Streptomycetes population ($12x10^2$/g) was observed in *U. fasciata* in Actinomycetes agar medium. Artificial feed formulation and its protein content is given in the (Table 2).

Table 1: Total numbers of microbial population form five selected seaweed of Kovalam cost in three different media

Source	Kuster's agar medium			CFUx10^2/g dry weight Actinomycetes agar medium			Glycerol Asparaginase agar medium		
	B	S	F	**B**	**S**	**F**	**B**	**S**	**F**
U. fasciata	6	4	1	9	12	*	4	4	*
C. antennina	**	4	*	15	2	9	24	5	2
S. wightii	**	3	*	*	5	2	1	3	12
C. racemosa	*	*	*	11	5	6	5	5	6
G. corticata	5	9	*	**	2	*	11	3	*

*B: Bcteria S: Streptomycetes F: Fungi *: Not detected **: Too Numerous To Count*

Table 2: Ingredient composition of artificial diet containing different single cell protein

Ingredients	Diets (gm)			Protein (%)
	D1	**D2**	**D3**	
Fishmeal	3.420	-	2.011	58.85
Ground nut oil cake	3.420	03.40	2.011	45.00
Bengal gram	46.798	46.61	46.982	43.70
Rice bran	46.798	46.61	46.982	13.30
Streptomycetes	-	03.40	2.011	56.21

Table 3: Weight gain, food conversion efficiency and conversion ratio of *Brachydanio rario* fed with different single cell protein

Parameters	Diets		
	D1	**D2**	**D3**
Initial weight (g)	0.401	0.427	0.310
Final weight (g)	0.419	0.450	0.320
Production (g)	0.018	0.023	0.010
Feed given (g)	0.10	0.107	0.078
Unconsumed feed(g)	0.026	0.016	0.029
Feed consumed (g)	0.074	0.091	0.049
Conversion efficiency (%)	24.324	25.275	20.408
Conversion ratio	4.111	3.957	4.900

Maximum conversion efficiency was observed in the fish group fed on diet D2 (25.275%) in which 30% of fishmeal was replaced by Streptomycetes followed by D1 (24.32%).Minimum conversion efficiency was obtained in D3. The better conversion ratio provided by diet D2 (3.957) followed by D1 (4.111). The lowest conversion ratio was obtained in D3 (4.900). The results clearly revealed the fact that better conversion efficiency and better conversion ratio were obtained in the fish fed on diet containing Streptomycetes (D2) (Table 3).

Discussion

Single Cell Protein can replace abut 25 - 50% of the fish meal component from the artificial pelleted feed of fish and shellfish (Beck *et al.*,1978).The present investigation showed that the Streptomycetes diets has promising opportunities in animal nutrition and also the work shows increase conversion efficiency and better growth from the fish selected. So the fish may efficiently utilize the Streptomycetes present in the diet for their body building purpose. As they are rich in protein and other essential vitamins, the organism need them in very negligible quantity than the control feed? The present finding conforms to the result of Dhevendaran and Anithakumari (2000) in which maximum conversion efficiency was observed in the fish *Puntius vittatus* fed on diet D3 (79.781) in which 20% of the fish meal was replaced by Streptomycetes.

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