International Research Journal of Natural and Applied Sciences
ISSN: (2349-4077)
Impact Factor- 5.46, Volume 5, Issue 4, April 2018
Website- www.aarf.asia, **Email** : editor@aarf.asia , editoraarf@gmail.com

EVALUATION OF GROWTH AND BIOCHEMICAL CONTENTS OF *GAMBUSIA AFFINIS* FED WITH *SARGASSUM WIGHTII* SUPPLEMENTED *SPIRULINA PLATENSIS*

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ABSTRACT

Spirulina platensis is a filamentous blue green algae, it could be used to replace high protein feed ingredient such as fish meal and soybean meal to save the costs of feed. It has been used to improve the immune system and increase the survival rate of fish, as well as to increase their flesh pigment. The present investigation has been conducted to understand the effect of S. platensis as a feed supplement on survival and weight of Gambusia affinis for a period of 90 days. Highest weight gain was observed in seaweed Sargassum wightii and panchagaya supplemented S. platensis on Gambusia affinis. Which was recorded to be 100% in case of survival rate, 1.97 and 1.77 gm in case of weight respectively. The highest protein contents were found at fish fed with S. wightii supplemented S. platensis in the diet with the values of 38.06%, followed by fish maintained at panchagavya in the diet which were 34.89 % over the control (33.87 %) As well, flesh pigments also significantly high. Hence, it can be

concluded that S. platensis is a good supplement to raise the fish growth performance and survival ability.

Keywords: Gambusia affinis, Spirulina platensis, Sargassum wightii and panchagaya

Introduction

Aquaculture production is a major industry in many countries, and it will continue to grow as the demand for fisheries products increases and the supply from natural sources decreases. Of the global aquaculture production, Asia produces 91%, Europe 4.7%, North America 1.8%, China 65% and India 7% of aquaculture food (Kathirvelu, 1996; Kutty 1999; Sakthivel, 2001).

Spirulina platensis cultivation is wide spread in aquaculture applications particularly due to the use of their pigment as feed for tropical fish (Vonshak and Richmond, 1988). So aqua culturists need to culture *S. platensis* for their extensive use (Jeeji Bai, 1998). Mosquito borne diseases continue to be a major problem for the transmission of the pathogens causing malaria, yellow fever, dengue fever, chikungunya, filariasis, encephalitis, etc. Japan is the largest market for aquaculture grown fish. *Spirulina platensis* improves skin colour, growth rate and even the smell (Henson,1990). *Spirulina* is a cyanobacterium that has been commercially due to its high nutritional content. E.g. protein, amino acid, vitamin, minerals, essential fatty acid and b - carotene (Vonshak, 1997).

The protein level of *S. platensis* is as high as animal protein, ranging from 50-70% of algal dry weight and it is used as a protein supplement for human food and animal feed. Photosynthetic pigments, including chlorophyll a, carotenoids and, phycobili proteins are the major pigments of *S. platensis* (Chen *et al*., 2006). To date, there is a limited amount of data that could be used to improve the growth of the *G. affinis* supplemented with *S. platensis*. The objective of this research to evaluate the effect of seaweed fertilizer obtained from *S. wightii* and panchagavya are used for *S. platensis* culture and the product is used as *G. affinis* feed. *Gambusia affinis* has traditionally been referred to as mosquito fish, and used in mosquito control programs.

Materials and methods

The *Gambusia affinis* was obtained from the fish collectors, Nagercoil, Kannyakumari District, Tamilnadu. In a total of 20 fishes, the average weight of each fish was determined

before the experiment. The fish was fed with different types of diet with *S. platensis.* Diets such as feed with 100% fish meal (control), feed with100% *S. platensis* powder treated with *S. wightii* and the feed with100% *S. platensis* powder treated with panchagavya. Three small (5 litre quantity) fish tank were used. A clean beaker was used and an average depth of 1 meter water level was maintained, healthy individuals of *G. affinis* having 0.89, 0.83 and 0.82 g weight were introduced after acclimated for a fortnight feeding on the experimental diet in to the tank 1, tank 2and tank 3 respectively.

Hydrilla plant was introduced into the tank for the fish to hide. The average weight of each fish was determined before the experiment. Each diet in triplicate was maintained in fish tank with 5L water. One group served as control. The feeding was adjusted to two times a day (6:00 am and 6:00 pm). The feeding experiment was prolonged for one month; mild aeration was given continuously in order to maintain the optimal oxygen level, temperature (Mercury thermometer) and pH (Schott - Gerate CG 840) was measured.

Sample fishes were collected once in five days with the help of nylon net. The collected fish were measured and weighed and then re-introduced into the respective tank. Concentration of total protein was estimated by using the method of Lowry *et al.*, (1951). Carbohydrate content was estimated by the method of Roe (1955) and total lipid was extracted with chloroform - methanol mixture by following the method of Barnes and Black-Stock (1973) and estimated by the method of Folch *et al.*,(1957).

Results and Discussion

Growth performance of *G. affinis* fed with commercial fish meal

The influence of commercial fish meal fed *S. platensis* on growth performance of *G. affinis* during the 90 days of experiment is shown in the Table 1. The mean weight of *G. affinis* on the first day of stocking in the control (100% fish meal treated) was 0.89g. At the end of the experiment, the mean weight of the control fishes were found to be 1.71 g and Fishes fed with *panchagavya*, and *S. wightii* showed the mean weight of 1.77 and 1.97g. The temperature showed variation from 26 to 29°C. The pH fluctuated from 7.56 to 7.96 (Table 1). Hence coming to conclusion that using *S. wightii* supplemented *S. platensis* in the fish can raise its growth performance and survival ability.

Growth characteristics of *G. affinis* in *S.wightii* supplemented *S.platensis*

The present investigation has been conducted to understand the effect of *S. platensis* on growth performance of *G. affinis* for a period of 90 days. After 90 days, when compared with 100% fish meal treated group (1.71 g), the body weight of *S. wightii* supplemented *S. platensis* group fishes were increased (1.97 g) (Table 1). The temperature showed variation from 26°C to 29°C. The pH varied from 7.56 to 7.82.

Influence of *panchagavya* supplemented *S. platensis* on *G. affinis*

Panchagavya supplemented *S. platensis* was used as supplementary feed. One experimental diet consisting of *S. platensis* meal was used in the trial and compared to a control diet (100 % Fish meal). The initial weight of *G. affinis* from the control group was 0.8 g, whereas the group fed with experimental feed was at 0.82 g. The weight gain, condition factor and average daily growths of *G. affinis* fed with experimental diet were higher (1.77 g) than those from the group fed with feed without algae supplement (1.71 g). The temperature showed variation from 25 to 29 °C. The pH varied from 7.54 to 7.81.

Proximate composition of *G. affinis* fed with experimental diet

Proximate body composition of *G. affinis*, results in Table 2 showed that there is a significant difference were observed in fish weight (g), protein (%), carbohydrate (%), lipid (%) and pigment (%). Proximate body composition of *G. affinis* results were showed in figures 1 - 4. The highest protein contents ($P<0.05$) were found at fish maintained at *S. wightii* in the diet with the values of 38.06%, followed by fish maintained at panchagavya in the diet which were 34.89% over the control (33.87 %). Fish fed diet containing *S. wightii* get the highest significant ($P<0.05$) carbobydrate content having the value of (3.9 %). However, the least carbohydrate contents were recorded with fish maintained at panchagavya diet with the value of 3.6% compared to 100% fish meal diet (3.4%).

Lipid content in the fish body showed significant differences among treatments (100% fish meal, *S. wightii* and *panchagavya* ($P<0.05$). Fish maintained at *S. wightii* in the diet were significantly the highest ($P<0.05$) in body lipid content than other treatments, with the value of 2.11%, followed by fish maintained at *panchagavya* (1.82%) over the control (100% fish meal 1.34%). The result clearly showed that the maximum pigment level was present in the fish fed with seaweed *S. wightii* (3.24%) and the minimum pigment level (2.86%) was reported in the fish fed with panchagavya when compared to control (2.69%), respectively. The type of feed ingested and their nutritional quality is known to be one of the

main factors affecting fish body composition (NRC, 2011; Alltech, 2013). Superior performance of fish with the experimental diet (*S. wightii*, panchagavya and 100% fish meal) reflects on the ability of *G. affinis* to utilize the supplementary ingredients effectively. There has also been comprehensive research on the use of *Spirulina* as aquaculture feed additives in Japan (FAO, 2008). The long-term sustainability of aquaculture may be threatened by its present over-dependence on fish meal and fish oil (FAO, 2002). Therefore an intensive effort during these last decades has been made in order to evaluate the potential of alternative protein sources in aquafeeds (Alexis, 1997). Although several studies were conducted to evaluate the replacement of fish meal by plant ingredients in diets of fish (Gouveia andDavies, 2000; Kaushik *et al.*, 2004).

Conclusion

The present study concluded that seaweeds (*S. wightii)* can be supplemented to *G. affinis* diet to improve their growth performance without any adverse effect on feed efficiency or survival rate. Hence the present study indicated the beneficial role of selected algae *S. platensis* supplemented with *S. wightii* and panchagavya the growth promoters for mosquito fish *G. affinis.* The overall study shows that *S. wightii* supplemented feed increased the biomass, pigment of the fishes when compared to panchagavya and control.

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Table 1- Growth performance of *G.affinis* fed with commercial fish meal,*S.wightii* and panchagavya supplemented*S. platensis*

Days	Control(100% fish meal)			*S. wightii*			Panchagavya		
	Temperature °C	pH	Weight (g)	Temperature °C	pH	Weight (g)	Temperature °C	pH	Weight (g)
1	27	7.55	0.89±0.15	27	7.56	0.83±0.28	28	7.54	0.82±0.12
6	26	7.58	0.82±0.18	26	7.57	0.92±0.32	25	7.56	0.87±0.19
12	26	7.59	0.84±0.22	27	7.58	0.98±0.38	26	7.59	0.94±0.51
18	26	7.6	0.92±0.11	27	7.62	1.06±0.19	26	7.6	0.99±0.26
24	26	7.62	0.99±0.16	27	7.62	1.14±0.26	25	7.64	1.05±0.22
30	26	7.67	1.03±0.26	27	7.63	1.22±0.44	26	7.64	1.11±0.21
36	28	7.65	1.09±0.28	28	7.64	1.3±0.39	28	7.7	1.18±0.13
42	26	7.67	1.15±0.29	29	7.65	1.38±0.35	27	7.72	1.25±0.47
48	27	7.7	1.25±0.31	29	7.96	1.45±0.58	28	7.73	1.33±0.37
54	27	7.75	1.32±0.41	29	7.66	1.54±0.51	28	7.74	1.41±0.51
60	26	7.74	1.4±0.39	28	7.67	1.62±0.21	27	7.75	1.45±0.11
66	26	7.74	1.45±0.28	28	7.68	1.69±0.27	28	7.77	1.51±0.16
72	26	7.75	1.52±0.48	28	7.7	1.75±0.31	28	7.79	1.58±0.14
78	27	7.76	1.59±0.37	29	7.76	1.81±0.26	28	7.8	1.66±0.55
84	27	7.77	1.67±0.51	29	7.79	1.88±0.19	29	7.81	1.71±0.17
90	29	7.78	1.71±0.49	29	7.82	1.97±0.41	29	7.81	1.77±0.31

Table 2 - Proximate composition of *G.affinis* fed with experimental diet

Sample	Fish control	*S.wightii*	%over control	*Panchagavya*	% over control
Fish weight(g)	1.71±0.49	1.97±0.41	0.2746	1.77±0.31	0.0712
Protein%	33.87±0.02	38.06±0.04	6.3360	34.89±0.01	1.5424
Carbohydrate %	3.4±0.03	3.90±0.02	0.5175	3.6±0.01	0.2070
Lipid%	1.34±0.02	2.11±0.02	0.7804	1.82±0.02	0.4865
Pigments%	2.86±0.02	3.24±0.02	0.3911	2.69±0.01	0.1750

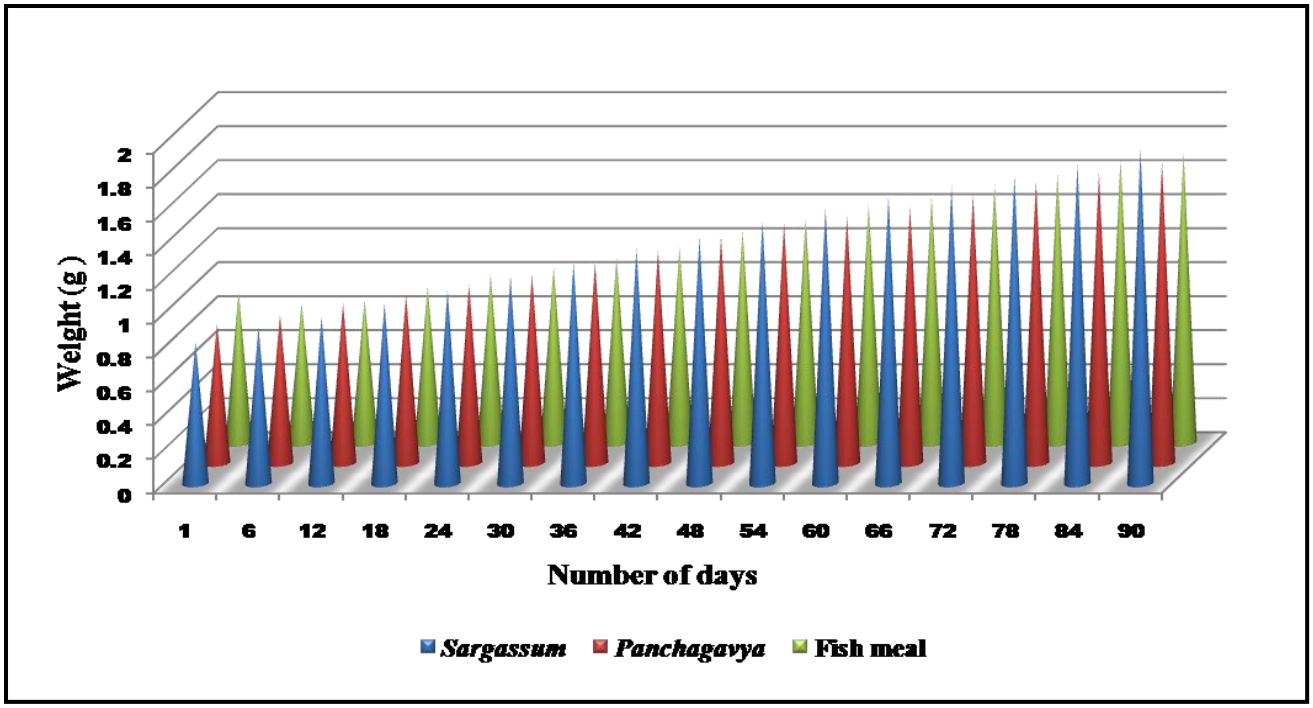

Figure: 1 Biomass of *G. affinis* fed with different experimental diets

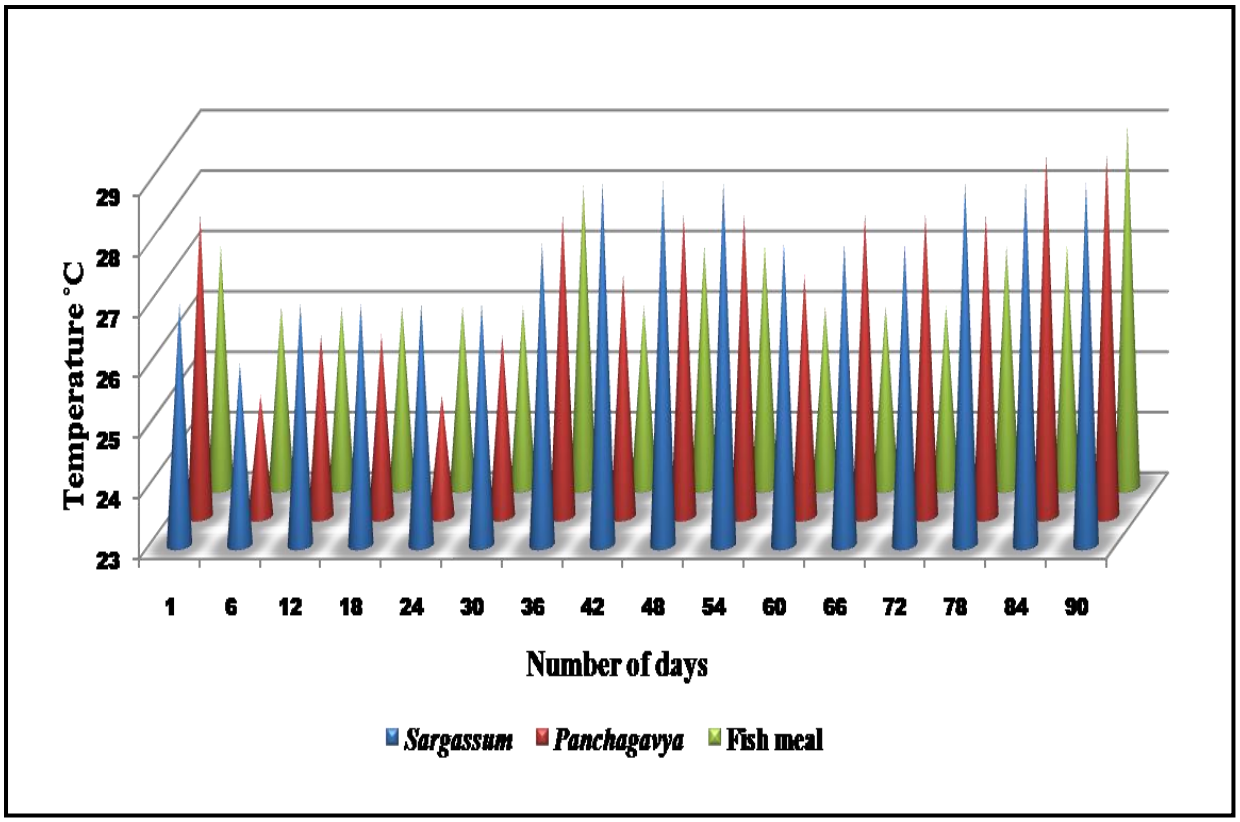

Figure: 2 Effect of temperature on growth of *G. affinis* fed with different experimental diet

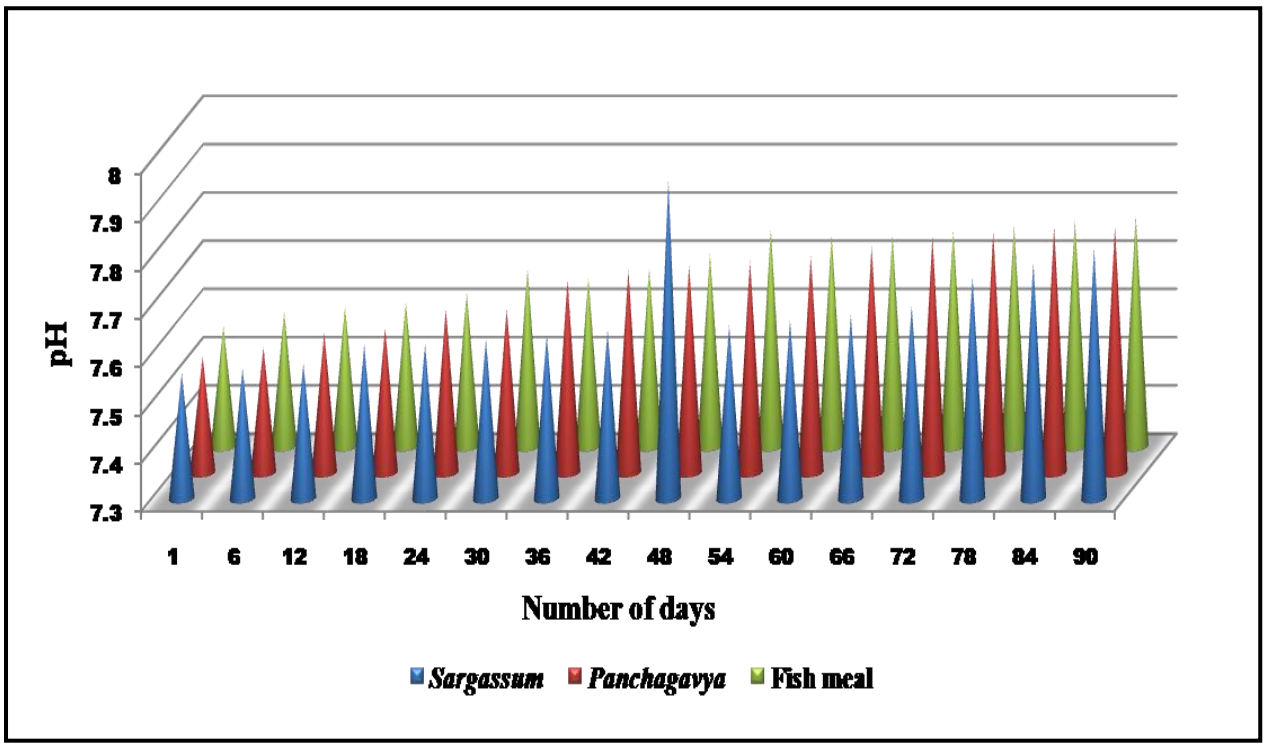

Figure 3- Effect of pH on growth of *G. affinis* fed with different experimental diets

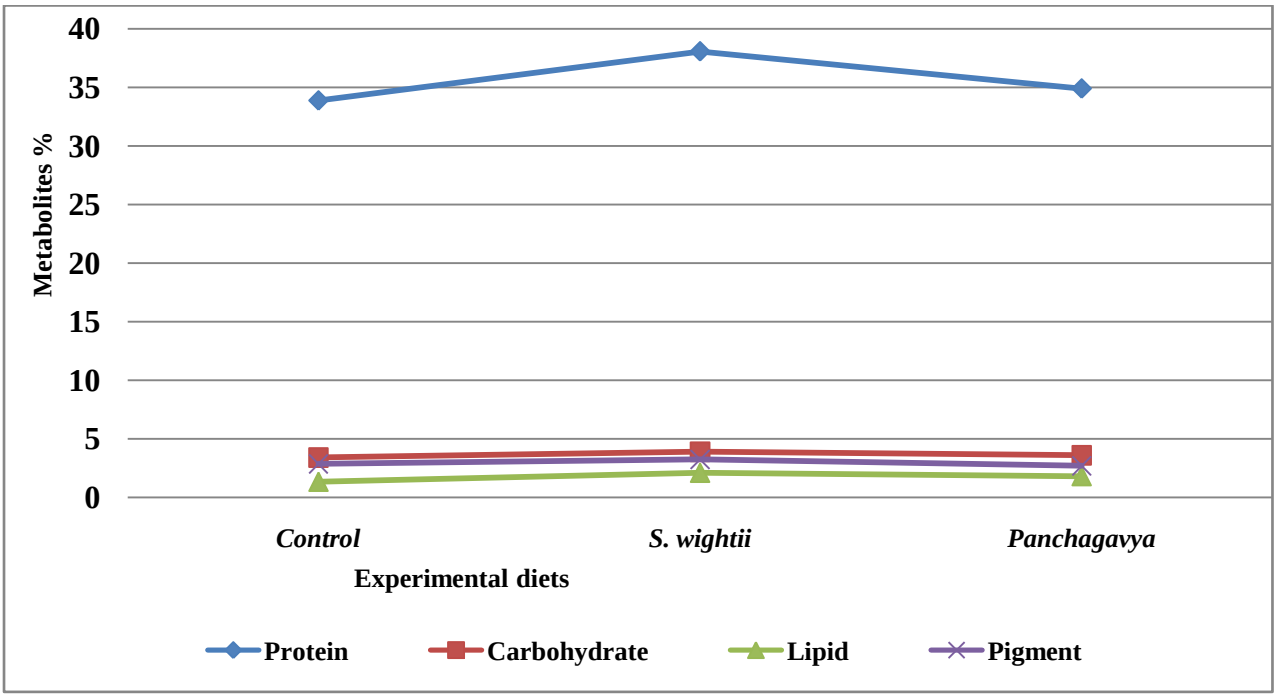

Figure 4: Proximate composition of *G. affinis* fed with experimental diets