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Dunaliella salina - an unconventional live feed

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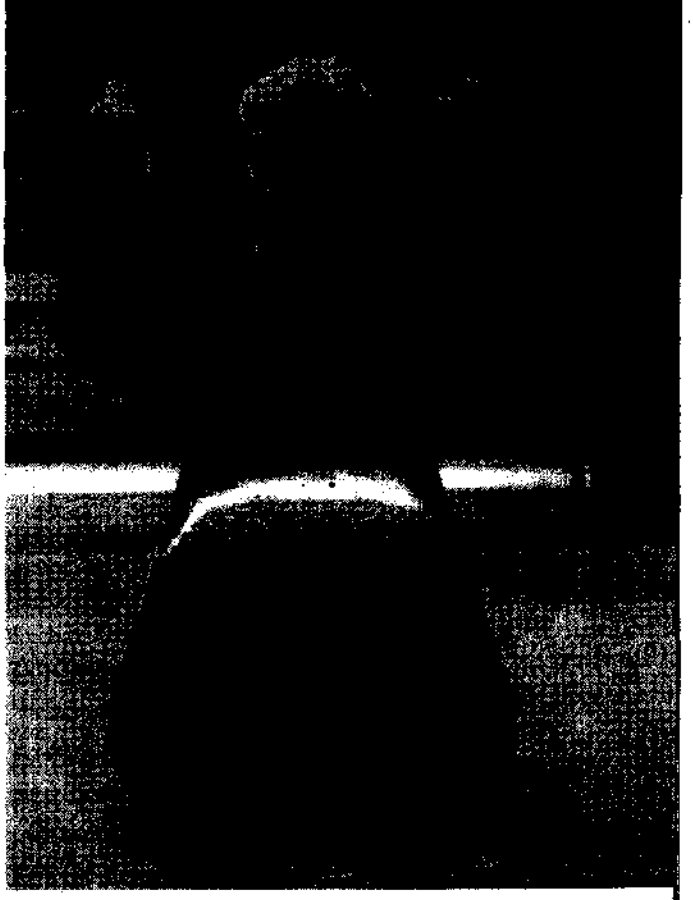
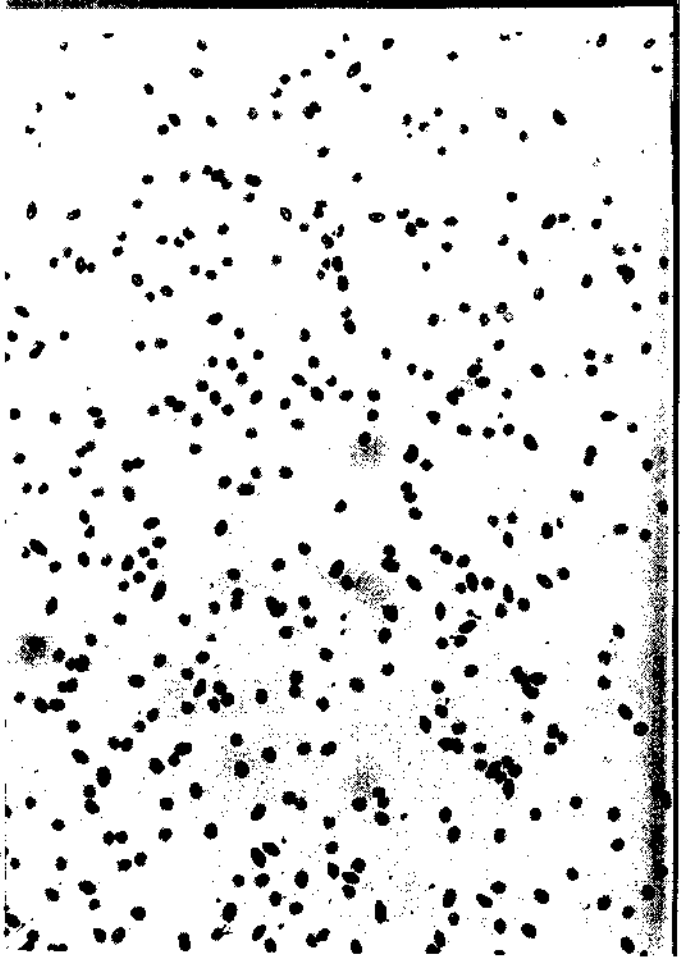


ABSTRACT

Live feeds play an important role in aquaculture operation. Presently, the groups of live feeds employed in the culture systems are limited to a few species of phyto and zooplankters. Dunaliella salina, *(greenmicroalga), a member of Chlorophyceae, is an unconventional live feed. The culture of this species is presently limited to laboratory experimental stage only.*

In view of the paucity of studies on the culture and utilization of Dunaliella salina, *the present investigation was undertaken to explore and estimate the potential use of this species. The results of rearing of juvenile clams with* Dunaliella *as live feeds are presented and discussed.*



Introduction

In aquaculture systems, several live feeds are used presently such as *Chaetoceros, Isochrysis, Skeletonema,* etc. The hatchery rearing of prawn/ mollusc larvae is dependent on these live feeds. There are innumerable species of phytoplankton in our waters; but only very few of them are used as live feeds in aquaculture. In view of this, the present study was undertaken to evaluate the culture possibilities of *Dunaliella salina* and to study its effect on the growth, survival rate and performance in juvenile clams.

Dunaliella salina is a member of Chlorophyceae; a green halotolerant (ie., thrives in media with a very board range of salt concentrations) microalga. The dominant pigment - chlorophyll, is masked by the presence of a pigment - haematochrome. It accumulates large amounts of commercially valuable chemicals - glycerol b and - carotene. *Dunaliella* is cultured in coastal ocean areas in large outdoor ponds in regions of high solar radiation and moderate temperatures. An attempt has been made in this brief work to evaluate the performance of *Dunaliella salina* in laboratory / hatchery conditions.

Materials and methods

Four live feeds *viz, Dunaliella, Chaetoceros, Tetraselmis* and *Nanochloropsis* were cultured in laboratory conditions using Walne's medium in sterilized seawater at 30 ± 2ppt salinity.

Juvenile clam of *Villorita cyprinoides* (7.52g average initial weight) were brought from a local farm off Cochin and reared in 8-10 ppt salinity under labouratory conditions. The clams were acclimatized for rearing in 8-10 ppt salinity under laboratory conditions. The clams were acclimatized to the rearing conditions for over a period of one week. Prior to starting of the experiment, the clams were starved for 48 hrs. The clams were then grouped into four goups; each group containing 10 animals (Table 1). Each group was fed on separate feeds to study the comparative efficiency of *Dunaliella* with respect to the other conventional live feeds.

Table 1. Groups, feeds and feeding rate used in the experiment

Groups	Feeds	Feeding rate
Group I	*Dunaliella*	500-700 cells/ml
Group II	*Chaetoceros*	-do-
Group III	*Tetraselmis*	-do-
Group IV	*Nanochloeopsis*	-do-

The animals were maintanined in separate tubs with 3 l of filtered seawater. The feed ration was divided into two and given at intervals of 8hrs. 100% water exchange was done every day. The feeding rate (ingestion rate) was determinded as :

$$\text{Feeding rate or ingestion rate} = \frac{C1 - C2}{nt} \times V \times 60$$

where, C1 - initial cell concentration (cells/ml)

C2 - final cell concentration (cells/ml)

V _ Volume of water (l)

t _ duration of the experiment

n _ no. of animals.

The animals were reared with the respective feeds for a period of 15 days. At the end of the experiment, the animals were sacrificed and their biochemical composition estimated. Growth and survival rate was also studied. Biochemical assays were carried out to estimate the protein, carbohydrate and lipid contents.

- Protein was estimated following the procedure of Lowry *et al.* (1951). The values were obtained by comparing with standard graph.
- Carbohydrate was estimated using Glucose as standard.
- Fat (lipid) was determined using gravimetric method.

Simultaneously a group of 10 clams were maintained as control for the same length of period as that of the experimental only. All conditions were the same for this group also, except that they were not fed any feed.

Culture of *Dunaliella* : The candidate species, *Dunaliella salina*, was cultured in three different media for a period of 15 days at 30 ppt salinity and 24°C.

Medium I - Walne's medium

Medium II - Miquel's medium

Medium III - Enriched seawater medium (modified 'F' medium).

20 ml of *Dunaliella salina* was inoculated into 500 ml of filtered and sterilised seawater containing the respective medium. The culture was carried out in triplicates. (1 ml of inoculum contains approximately 500 cells/ml).

Ressults

Feeding experiment: The performance of each group of clams was monitored. The efficiency of the feed was determined in terms of growth, survival and biochemical changes of the clams. A summary of the results obtained is shown in Table 2. No mortality was reported with any of the feeds. However, the results were discouraging with respect to *Dunaliella* fed clams. Clams fed on *Dunaliella* showed comparatively less protein and carbohydrate contents. However, they showed better lipid profiles, as explained elsewhere. The growth rate was more with *Dunaliella* fed clams as seen in Table 2; but biochemical estimation gives comparatively lower values for *Dunaliella* fed clams.

Table 2. Growth and biochemical composition of the differet groups of clams

Group	Feed fed	Av. initial weight(g)	Av. final weight(g)	% growth	Protein (/g)	Carbohydrate(/g)	Lipid*
I	*Dunaliella*	8.69	8.86	1.96	21µg	0.55µg	0.249
II	*Chaetoceros*	11.42	11.45	0.263	30µg	1 µg	0.249
III	*Tetraselmis*	9.73	9.79	0.617	28µg	0.8µg	0.109
IV	*Nanochlor*	12.28	12.30	0.163	10µg	0.4µg	0.135

* Expressed as mg lipid/ gm tissue.

Culture of *Dunaliella* : The performance of each media was determined taking into consideration the following facts:

incubation period, ie, the time taken for the culture to start growth. - exponential period - the duration for which the bloom lasts.

final maximum no. of cells/ml at the time of harvest.

Accordingly, the medium with the least incubation period and highest exponential period along with better biochemical results is recommended as the ideal one. The results of culturing *Dunaliella* with the different media is given in Table 3.

Table 3. Results of *Dunaliella* culture with different media

Media	Initial no. of cells/ml	Final no. of cells/ml	Incubation period (days)	Exponential period (days)	Biochem. compostion		
					Protein µg/g	Carbo-hydrate. µg/g	Lipid mg/g
Walne's	500	13x103	3 to 4	one month	17.5	14	0.773
Miquel's	-do-	*	two weeks	one week	-	-	-
Modified F	-do-	*	-	-	-	-	-

* not determined as culture did not develop.

In the case of Walne medium blooming started within three to four days after inoculation. With Miquel's medium, blooming took ten to eleven days and declined in about two days time. With modified 'F' medium, there was no blooming at all. Since, the amount of sample that could be obtained from these two media ('F' and Miquel media) were very less, no biochemical estimation of these could be carried out. However, biochemical studies were carried out with *Dunaliella* cultured in Walne medium.

Discussion

Clams fed with *Danaliella* showed a higher percentage of growth (1.96%) compared to the other groups. Also, *Dunaliella* fed clams showed an increased lipid content (0.2488 mg/g) compared to other groups. This is attributed to the high levels of glycerol accumulated by *Dunaliella* in culture conditions (Della et al. 1995). Studies on feeding *Artemia* with *Dunaliella* have given large scale mortality. Similarly, with shrimps also mortality and collapse of culture has been recorded (C.P. Gopinathan, unpublished).

The results indicate that *Dunaliella* is not a substitute for the al-

ready widely used live feeds such as *Chaetoceros* and *Tetraselmis*. But, it can be incorporated as a supplementary live feed in molluscan culture. The study also indicates that *Dunaliella* is not toxic to juvenile and adult calms. The effect of rearing larval molluscs with *Dunaliella* remains to be studied. As regards the lower biochemical values obtained with *Dunaliella*, it can be mentioned that *Dunaliella* uses a lot of its energy on photoconversion - where the dominant green pigmet is converted into Xanthophyll. Also the higher lipid values explains the lower protein and carbohydrate values.

The results indicate that Walne medium is the ideal one for culturing *Dunaliella*. With this medium a good bloom of the culture and excellent exponential growth is obtained.

References

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