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RESEARCH ARTICLE

STUDIES ON THE CULTURE OF *ARTEMIA* USING RICEBRAN SUPPLEMENTED WITH MARINE YEAST *(DEBARYOMYCES FORMICARIUS)*

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ABSTRACT

The brine shrimp *Artemia* is playing an important role in aquaculture. The global requirements of *Artemia* biomass and cyst as important sources of live food for a wide variety of shrimps and fishes increased with the development of intensive aquaculture technology. The demand for large quantities of high quality *Artemia* biomass and cyst is increasing exponentially. A huge volume of coconut water is wasted by the local farmers which is a good organic source for the culture of marine yeasts. In the present study coconut water is used as the culture medium for the yeast growth. *D. formicarius* was cultured by the coconut water. After 48 hours yeasts were harvested and mixed with rice bran, then fed to *Artemia* at different concentrations. The Yeasts cultured in coconut water medium supported maximum growth, survival and reproduction of *Artemia*. The effect of marine yeast (*D.formicarius,)* cultured in coconut water on the growth, survival and reproductive performance of *A.parthenogenetica* are undertaken in order to formulate a good quality feed for *Artemia.*

INTRODUCTION

Aquaculture holds a great deal of promise in solving the major challenge of developing countries namely the production of sufficient food for the growing population (Chong, 1998). India is the seventh largest fish producing country in the world (Ravichandran, 1994). The availability of suitable coastal brackish waters and the natural facilities have promoted shrimp culture on a large scale in India (Suseelan *et al*., 1992). There is a booming demand for Indian pink gold (prawns). Today it has become an industry all along the Indian coast. The use of different feeds in aquaculture has increased production and profits considerably (Akiyama, 1988).

Successful aquaculture demands the availability of reasonably priced food suitable for the culture organisms. Reliable diets can satisfy the nutritional requirements of a given species and their availability at a reasonable cost is highly essential (Bengtson *et al*., 1991). Variety of micro algae, yeasts, sea weeds, rotifers, plant products, ayurvedic products, zoo planktons etc were used as feed for culture organisms by different researchers. In the present study to culture the Artemia using the marine yeast with a help of ricebran using coconut water.

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The following are the major objectives of this present study

- To utilize the waste coconut water as a raw material for the culture of marine yeast (*D.formicarius*).
- To identify the optimum salinity, P^H and temperature which supports maximum growth of yeast.
- To study the effect of various concentrations of three yeasts on the growth, survival and reproduction of *A. parthenogenetica.*
- To select the suitable marine yeast as a basic concentration.
- To evaluate the quality of the fresh and one year old feed.

Effect of salinity on the growth of D.formicarius

D. formicarius was cultured at different salinities in coconut water. D.formicarius grow well in the control (coconut water) which showed optical density as 1.99. Minimum growth was recorded at 25% salt concentration (O.D - 0.64)

Effect of P^H on the growth of D.formicarius

D.formicarius cultured at different P^H in the coconut water. It showed maximum growth at the P^H 4 (O.D- 1.99) and the minimum growth at the P^H 8 and P^H 10 (O.D – 1.66). It was interesting to note that D.formicarius showed maximum growth at the P^H 4 i.e. the P^H of the coconut water used for the culture of the marine yeast.

Effect of temperature on the growth of D.formicarius

D.formicarius was cultured at different temperatures in the coconut water. Impact of different temperatures on the growth of *D.formicarius* showed the following results. This yeast showed maximum growth at 25^{o}C (O.D – 1.13). Minimum growth was recorded at 40^{o}C (O.D – 0.20).

RESULT AND DISCUSSION

Survival (%) of Artemia parthenogenetica fed with different concentrations of fresh feed (Debaryomyces formicarius cultured in coconut water) – Reared from naupliar stage onwards. Each value is the mean (± S.D) of five replicates.

	Concentration (mg)					
Time (days)	Control	0.2	0.4	0.6	0.8	1.0
4th	84.8 ± 5.21	98.4 ± 2.19	94.4 ± 2.19	98.4 ± 2.19	97.6 ± 3.57	86.6 ± 4.66
6th	83.2 ± 3.34	97.6 ± 2.19	92.8 ± 1.78	96.0 ± 4.00	96.0 ± 4.00	82.4 ± 3.57
8th	76.8 ± 5.21	92.0 ± 6.92	88.8 ± 3.34	95.2 ± 5.21	93.6 ± 4.56	80 ± 4.00
10th	74.4 ± 6.06	88.8 ± 9.95	83.2 ± 11.7	84.8 ± 8.67	80 ± 10.19	68.8 ± 15.84
12th	74.4 ± 8.29	83.2 ± 5.93	78.4 ± 4.56	71.2 ± 9.12	69.6 ± 10.80	53.6 ± 11.86
14th	71.2 ± 5.21	79.2 ± 8.19	66.4 ± 10.80	66.4 ± 9.20	60.8 ± 11.09	45.6 ± 14.58
16th	71.2 ± 5.21	79.2 ± 8.19	66.4 ± 10.80	66.4 ± 9.20	60.8 ± 11.09	45.6 ± 14.58
18th	70.7 ± 8.22	78.4 ± 7.63	65.4 ± 10.73	65.2 ± 8.31	60.8 ± 11.36	42.4 ± 15.12
20th	69.4 ± 5.68	75.2 ± 10.05	62 ± 9.38	63.2 ± 8.19	59.6 ± 11.78	41.6 ± 14.09
22nd	68.6 ± 5.68	72.8 ± 9.44	59.6 ± 10.52	60.8 ± 10.35	56.8 ± 14.18	40.0 ± 13.63
24th	65.8 ± 3.03	71 ± 9.05	58.4 ± 9.73	60 ± 10.29	56.4 ± 13.74	38 ± 12.32
26th	65.2 ± 3.27	69.6 ± 7.92	57.6 ± 10.43	59.2 ± 10.15	55.2 ± 12.45	36.8 ± 11.54
28th	64.0 ± 8.64	69.4 ± 5.68	56.8 ± 14.18	57.6 ± 10.43	54.6 ± 10.73	34.8 ± 11.54
30th	60.0 ± 3.24	68.2 ± 5.68	55.2 ± 12.45	55.2 ± 12.45	54.6 ± 10.73	34.8 ± 11.54

In the present investigation a systematic analysis of the marine yeast on different salinity, P^{H} and temperature levels were attempted in order to estimate the most conducive levels of these media for the growth of marine yeasts. In the preset study coconut water was used as a medium for the culture of marine yeast. This was confirmed that high salinity levels may produce stress to the organism due to osmotic imbalance; Osmotic regulation requires active mechanisms such as permeability of water, water elimination of retention and salt retention or secretion. The different levels attempted by changing the p^{H} levels on the marine of yeast the population density is optimum in the control (O.D-1.99). In the case of temperature, there is consistency in the optimum level growth at 25^{0} C temperatures. This present result of the temperature studies supported by the earlier findings. Previous studies have to suggest that the *D. formicarius* had more protein content than the others. This information's supports the present study of the protein estimation of the yeasts. Cultured coconut water contained more protein than the fresh feed and the one year old feed. The greatest decrease in relative protein concentration was due to the decrease in growth rate and nutrient availability, especially nitrogen (Bai, 1998).

Survival (%) of Artemia parthenogenetica fed wth different concentrations of one year old feed (Debaryomyces formicarius cultured in coconut water)–Reared from naupliar stage onwards. Each value is the mean (± S.D) of five replicates

	Concentrations (mg)					
Time (days)	Control	0.2	0.4	0.6	0.8	1.0
4th	74.4 ± 6.06	98.4 ± 2.19	98.4 ± 2.19	95.2 ± 3.34	92.0 ± 4.89	95.2 ± 5.21
6th	74.4 ± 6.06	98.4 ± 2.19	98.4 ± 2.19	95.2 ± 3.34	92.0 ± 4.89	95.2 ± 5.21
8th	74.4 ± 6.06	94.4 ± 6.06	96.8 ± 5.21	94.4 ± 4.56	92.0 ± 4.89	95.2 ± 5.21
10th	71.2 ± 5.21	92 ± 9.38	93.6 ± 6.06	88.0 ± 6.32	84.8 ± 5.21	92.0 ± 8.0
12th	70.7 ± 8.22	87.2 ± 12.45	88.8 ± 5.21	82.4 ± 10.80	80.8 ± 3.34	90.4 ± 8.29
14th	69.4 ± 5.68	82.4 ± 11.48	80.8 ± 7.15	79 ± 11.48	79.2 ± 4.38	84.8 ± 9.54
16th	68.6 ± 5.67	72.8 ± 9.54	75.2 ± 9.95	72.8 ± 7.69	73.6 ± 2.19	73.6 ± 6.69
18th	66.4 ± 5.64	70.0 ± 9.32	75.2 ± 9.95	70.0 ± 9.32	70.4 ± 2.48	68.8 ± 10.35
20th	63.4 ± 5.60	68.4 ± 8.42	74.3 ± 9.80	68.4 ± 8.42	68.8 ± 10.35	67.6 ± 10.30
22nd	56.3 ± 4.34	60.0 ± 8.42	73.2 ± 8.72	68.4 ± 8.42	67.6 ± 10.30	67.6 ± 10.30
24th	50.3 ± 4.34	56.4 ± 6.42	71.4 ± 8.63	68.4 ± 8.42	65.3 ± 10.0	64.2 ± 9.38
26th	44.2 ± 3.34	56.4 ± 6.42	68.4 ± 8.43	56.4 ± 6.42	64.2 ± 9.38	64.2 ± 9.38
28th	40.0 ± 3.34	55.8 ± 5.43	64.2 ± 6.45	56.4 ± 6.42	60.0 ± 6.84	64.2 ± 9.38
30th	33.0 ± 4.32	55.8 ± 5.43	60.6 ± 6.84	55.8 ± 5.43	57.3 ± 6.42	57.3 ± 6.42

One interesting thing in *D. formicarius* fresh feed treated animals survival was 80% at 0.4 mg concentration. It is obvious that, these three yeasts had some influence on the survival of *Artemia*. The yeast maximum survival 80% was showed by *D. formicarius* at 0.4 mg concentration. Minimum survival was noted at 1.0 mg concentration. This may be due to, the higher dose which caused reduced acceptability of the feed, probably due to reduced digestability. In the present investigation *Artemia* fed with *D. formicarius* yeast produced higher growth rate 12.6 ± 0.89 mm at 0.4 mg/g concentration. Growth was low when rice bran alone was used and high in all the tested animals on application of the yeast. In the present study a trial was made to show the influence of fresh feed and one year old feed of marine yeast. In the present investigation *Artemia* fed with one year old *D.formicarius* produced high survival rate 60.6% at 0.4 mg/g concentration. One interesting thing in the one year old feed is that *D. formicarius* produced maximum growth 11.8 mm rate at 0.4 mg/g concentration.

Maturation was faster at 0.4 mg/g concentration of one year old *D. formicarius* i.e. on 8th day. Control showed delayed maturation. The broods were produced by the animals fed with rice bran only. But other experimental groups fed with marine yeast produced five broods within the experimental thirty days. Maximum 131 ± 0.11 young ones were released by the one year old *D. formicarius*. From this study, it is understood that the fresh feed *D. formicarius* was suggested as

best feed which influence high survival, growth and reproduction. Regarding the concentration it is advisable to use 0.4 mg/g concentration *D. formicarius*. The marine yeast feed is very good feed for the culture of *A.parthenogenetica*. It involves very easy preparation procedure, less cost, good palatability and odour. This support the following report of Olguin, 1993. In selecting the feed, palatability, odour, buoyancy, physical consistency and cost were important criteria in addition to availability (Olguin, 1993). Comparison of the survival, growth and fecundity of *Artemia* fed with yeast with that of those supplied with rice bran revealed that yeast is a best feed for the following reasons. *Artemia* provided with yeast cultured in the coconut water in the present study attained a maximum length of 12.6 mm within a short period of 30 days whereas those provided with rice bran attained a length of only 6.4 mm. The survival percentage was only 33% in those culture supplied with rice bran whereas in the yeast supplemented culture it was 80%.

The fecundity in the yeast fed animals in terms of either the number of broods per animal or the number of off springs per animal was higher when fed with the marine yeast species than that of rice bran fed cultures.

Conclusion

D.formicarius showed very high survival at 60.6% at o.4mg/g concentration. From the above observations, the maximum growth was obtained in *D.formicarius* i.e. 11.8mm at 0.4mg concentration. The growth obtained in the fresh feed *D.formicarius* was higher. It produced 12.6mm growth at 0.4mg/g concentration. Anyway these yeasts are being used with the aim to stimulate the reproductive potential, the optimum concentration have to be finalized after knowing the influence of the feed on reproduction. Regarding the concentration, it may be advisable to use 0.4mg of *D.formicarius*. The feed comprising rice bran and *Debaryomyces formicarius* at 0.4mg/g concentration is found to be suitable concentration for the culture of brine shrimp, *A.parthenogenetica*. The findings of the present study would be highly useful in the culture practices of the brine shrimp *A.parthenogenetica* to produce a predictable quantity of quality *Artemia* biomass.

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