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Research Article

CYSTS PRODUCTION OF *Artemia franciscana* IN VARYING SALINITY

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Abstract: Artemia cyst production using brine of different salinities was studied. Brine of different salinities *viz*., 120, 140, 160 and 180‰ were used as culture medium for *Artemia cyst* production. Cysts production increased with increasing salinity up to 160‰, but declined in 180‰ salinity. About 32.34 and 40.60 per cent higher production of cysts was observed in 140 and 160‰ salinity rearing tanks respectively over 120‰, while 16.40% less production was observed in 180‰ rearing medium than 120‰. Significantly higher ($p>0.05$) cyst production of *Artemia franciscana* was observed in the rearing medium of 160‰ salinity.

Keywords: Artemia cysts, Salinity, Brine shrimp

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Introduction

Artemia commonly known as brine shrimp is one of the most important and preferable live feed in aquaculture. *Artemia* is found in marine environment and has unique characteristics to withstand and thrive well in high salinity brine water. Salinity below 100‰ female *Artemia* produces nauplii and in higher salinity it produces chitin encysted paused embryo in the form of cysts. This remains viable in the form of dry cysts for many years and can produce tiny nauplii within 24 hours when immersed in sea water. *Artemia* cysts have gained a unique position in aquaculture system as they are highly nutritive, can be stored under ideal condition for a prolonged period and hatched as and when require to get nauplii for feeding early larval stages of cultivable crustaceans and fish [1]. After decapsulation treatment the chitin shell free cysts can be used as live feed for crustaceans like *Penaeus monodon* and *Macrobrachium rosenbergii* [2,3]. The freshly hatched *Artemia* nauplii called Instar-I contains high lipid and unsaturated fatty acid, so it is the great source of energy for shrimp larvae of stage Mysis-I to Post Larva-12 [4] and can be the best live feed for the larvae of M. rosenbergii [5,6], *Epinephelus tauvina* and *Lates calcerifer* [7]. The adult *Artemia* spp. has also been recorded to be an ideal live feed for stage-8 larvae of *M. rosenbergii* [8]. A more promising approach to understand the control of reproduction mode in *Artemia* spp. where many physical and chemical factors of water can be attributing to induce oviparity to viviparity [9]. This mode of reproduction in *Artemia* spp. is greatly affected by the environmental conditions in nature, but which factor exactly controls the mode of reproduction is still unknown. However, no single environmental factor is clearly responsible for controlling reproductive mode; moreover, interactions among several factors appear to be significant. *Artemia* has a unique potential and a promising future for large scale production of *Artemia* cysts and biomass for sustainable aquaculture in India. Brine shrimp nauplii are the main protein and HUFA (Highly unsaturated fatty acid) rich live feed input for the production of quality seeds in shrimp and finfish hatchery [10]. *Artemia* cysts are imported from U.S.A., China, Indonesia and Taiwan. About 3000 tonnes *Artemia* cysts being used in world with an average of 4-5 kg cysts per one million post larvae production in shrimp and finfish hatchery [11]. Presently in Gujarat only 3.8% of the potential (ready to use for brackishwater aquaculture) area is under cultivation and to fulfil the present requirement of seed, hatchery producers may need about 2000 kg dry weight *Artemia* cysts per annum, worth Rs. 12 million [12]. Growing capacity of Indian hatchery producers of 54 billion seeds production requires about 270 ton *Artemia* cysts every year [13]. Looking to the huge demand of *Artemia* spp. in shrimp and finfish hatchery operation, cysts production trials have been attempted in many parts of the world. During the cysts production of *Artemia* spp. appropriate feed and salinity of water play an important role on quality of cysts [14-17]. However, salinity of *Artemia* rearing medium and method might show different results.

Materials and Methods

Cysts production trials of *Artemia franciscana* were conducted. It involved hatching of *Artemia* cysts for nauplii production, rearing of *Artemia* nauplii to adult in maturation tanks and cysts production in the water of varying salinities.

Hatching of *Artemia* nauplius

For the production of *Artemia* nauplii the cysts of *Artemia franciscana* of jungle brand were used. Cysts were decapsulated following the techniques [18, 19]. Decapsulation and disinfection treatment was given to hydrated cysts using 4% sodium hypochlorite at the rate of 1ml per gram of cyst before introduction into hatching tanks. The glass beaker in which above treatment was given should be kept in cold-water vessels so, as to avoid damage of embryo due to heat produced during chemical treatment. The decapsulation treatment was given for five minutes. Later all cysts were washed thoroughly using freshwater in order to remove residual chlorine. Then treated cysts were introduced into hatching tanks of 28‰ water and provided with vigorous aeration and continuous illumination of about 1000 lux. Nauplii hatched out after 28-32 hrs and were collected for further rearing. The hatching efficiency of cysts was 78-82 per cent.

Rearing of *Artemia* nauplii in maturation tanks

In order to get matured *Artemia*, all nauplii were stocked in maturation tanks of 40‰ water and fed with live feed *chaetoceros* spp. for five days followed by a feed of *chaetoceros* spp. and rice bran extract for remaining period.

Cysts Production of *Artemia franciscana* in Varying Salinity

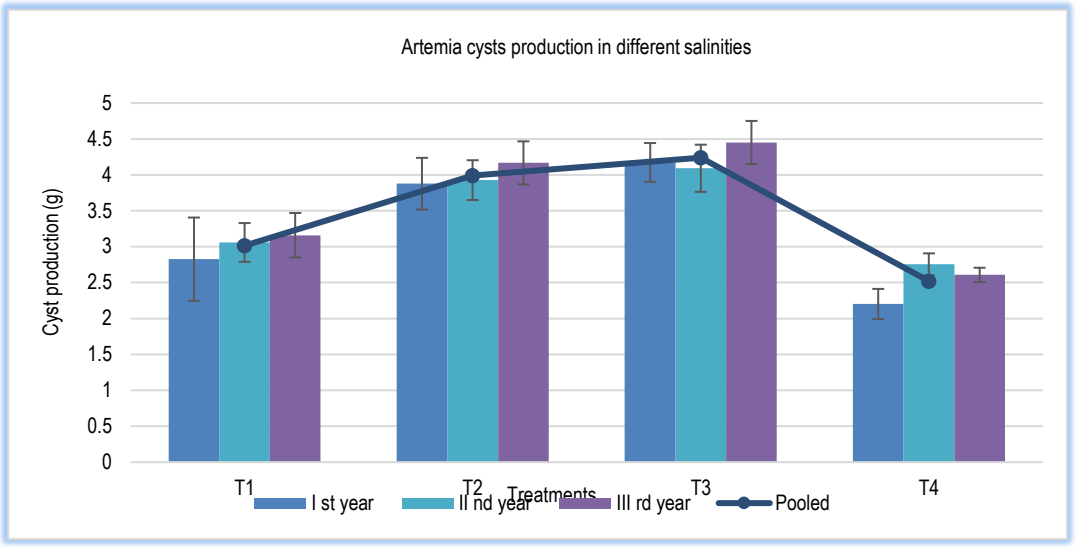

Fig-1 Year wise and pooled cysts (*Artemia franciscana*) production in different salinity of water as rearing environment

Salinity was increased by 5‰ daily and rose up to > 100‰. Nauplii metamorphosed in to adult after 18-20 days.

***Artemia* cysts production**

Brine of 320‰ salinity was brought from Arambhada salt farm of Tata chemicals Ltd., Mithapur (Gujarat) and prepared required salinity of water for rearing medium. The experiment was conducted in polythene lined earthen tanks of size 3m x 1m x 0.30m using CRD statistical design and five replicates of each treatment. The experiment was conducted during summer and repeated for three years. There were four treatments designated as T1, T2, T3 and T4 of varying salinities *viz*., 120, 140, 160 and 180‰ respectively. Matured *Artemia* at the rate of 30000 numbers per cubic meter were stocked in each tank for 75 days. *Artemia* of each tank were fed with 10 g mixture of 2:1 rice bran and soya flour twice in a day. The mixture was soaked in freshwater for four hour, and then passed through sieve of 300 micron so as to get particles of appropriate size. This mixture was then vigorously aerated for fifteen minutes before being given as feed to *Artemia*. Cysts were harvested fortnightly. Produced *Artemia* cysts were processed and stocked in dry airtight container [20].

Result

The results depicted in [Table-1] and [Fig-1] revealed that higher cysts production was observed in 140 and 160‰ salinity than 120‰ salinity rearing tanks. *Artemia* production showed increasing trend with increasing salinity up to 160‰, but declined in 180‰ salinity. About 32.34 and 40.60% higher production was observed in 140 and 160‰ rearing tank respectively over 120‰ salinity rearing medium, while 16.40% less production was observed in 180‰ rearing medium than 120‰. Live nauplii was also observed in 120‰ salinity rearing environment.

Table-1 Year wise and pooled cyst production (g)

SN	Treatments	Dry weight (g) Mean ±S.D			
		Ist year	IInd year	III rd year	Pooled
1	T1	2.826 ±0.58	3.059 ±0.27	3.159 ±0.31	3.015
2	T2	3.877 ±0.36	3.927 ±0.277	4.167 ±0.3	3.990
3	T3	4.173 ±0.27	4.092 ±0.328	4.451 ±0.3	4.239
4	T4	2.202 ±0.21	2.754 ±0.153	2.607 ±0.3	2.521
	S.Em ±	0.170	0.118	0.120	0.09
	CD.5%	0.510	0.355	0.359	0.260
	S.Em ± (Y x T)	-	-	-	0.14
	CD.5% (Y x T)	-	-	-	NS
	C.V%	11.623	7.656	7.442	8.974

Discussion

As per the ANOVA [Table-1] significantly superior (p>0.05) cysts production was observed in the rearing medium of 160‰. However, there was no significant difference in production of cysts between 140 and 160‰ salinity reared *Artemia*. However, Finger millet (Ragi), *Eleusine coracana* fed *Artemia* produced higher cysts in the rearing water of 130 ‰ salinity [17]. Available food of *Artemia* and its nutritional value also attribute to the growth and maturity of *Artemia* and subsequently on cysts or nauplii production [21]. However, *Artemia* fransciscan Mexican polulation grown in laboratory results higher cysts and low biomass of nauplii in the rearing medium of 140‰ [22]. Magnesium present in brine plays crucial role in osmoregulation of *Artemia* and subsequently for growth and survival [23].

Conclusion

Based on the results obtained from the experiment, it seems quite indicative that potential higher cysts of *Artemia franciscana* production can be obtained using water of 160‰ salinity as rearing environment. More than 500 salt farmers in South Vietnam produced 40 tonnes of *Artemia* cysts per dry season and earned income about 4000- 7500 US $ from 1 ha. saltfarms. Thus, income per house hold increased by 3 fold than the salt production [11]. Similarly, there is huge potential and opportunity to produce costly *Artemia* cysts from available saltpans in coastal region of Gujarat.

Application of research: Available large area of saltpans can be utilized for Artemia cysts production which have potential to create livelihood earning opportunity in coastal region.

Research Category: Aquaculture

Abbreviations:
‰- Parts per thousand
CRD- complete randomized design
ANOVA- Analysis of variance

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Ethical approval: This article does not contain any studies with human participants or animals performed by any of the authors.

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