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INTENSIVE CULTIVATION OF THE CALANOID COPEPOD *OITHONA RIGIDA* FOR MARICULTURE PURPOSE

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ABSTRACT

The cyclopoida copepod Oithona rigida has good potential for mass culture as a live feed. This study was carried out to investigate the effects of salinity on density of O.rigida four ranges with 15, 25, 35 and 45 ‰ and mass cultured under four salinity levels (15,25,35,and 45 ‰) in 5 L fiberglass tanks over 19 days culture period. However, it is better to be cultured at salinity of 35 ‰ for maximum population density growth. O.rigida was cultured at temperature 25-26 ℃ and fed with two algal diets including chlorella vulgaris and Skeletonema costatum. During the culture period production average was 6722 org/l. Among these, nauplii, copepodids and adults density was observed 2,625 org/l, 2,110 org/l, and 1, 987 org/l respectively. The present results concluded that O.rigida would be culture with mass production in stipulated period for mariculture purposes.

KEY WORDS

Oithona rigida, chlorella vulgaris and Skeletonema costatum.

INTRODUCTION

Copepods are small crustaceans one of the most diverse and numerous aquatic life forms, and can be found in both fresh and salt water environments at all stratifications. (Bjørnberg 1986, Dahms 2000). They are most important in the food chain; it is in secondary producer of Marine environment (Rajkumar, 2006). Marine copepods are most live feed for nourished of the fishes, Shrimp, prawn and other aquatic organisms (Santhanam, 2002). Production of marine copepods in the hatchery is important for solving the feed related problem in the rearing of fishes and crustaceans culture. (Szlauer and szlauer 1980). Copepods constitute a major part of the diet of fish larvae in the natural pelagic food chain (Cheng et al. 1999 &2001). Copepod cultivation is a useful basic procedure for aqua culturists, as they provide an important source of nutrition for fish fry (Lee et al 2005).

Cyclopoid copepods are dominated in the herbivorous zooplankton. Moreover they provide a wide size range of feed for hatchery (6 Naupliar stages and 6 copepodids stages). (Ferrari and Dahms 2007) In the worldwide geographical distribution, abundance, high rate of reproduction, small size, high nutrient valve, salinity tolerance, and are easily adaptable to laboratory condition they are considered to be the most suitable for mass culture. *Oitnona* as an ideal copepod for culture in worldwide from the available information. *Oitnona* spp appear to be the best candidates as they are relatively more nutrient condition to culture over several generations in the laboratory (Change and Lie., 1993). *Oitnona* spp form an ideal supplement to the traditional live feed rich source of protein, lipid (especially highly unsaturated fatty acids contents), carbohydrates, enzymes (amylase, protease, exonuclease and esterase) vitamins (C and E) in present the copepod feed. (Van der Meeren 2003).

Physico- chemical parameters play a key role in the culture circumstances. Among the constraints the salinity is one of the most important environmental

parameters affecting the seasonal and spatial distribution of marine copepods in the wild and can affect the spawning, incubation, survival rate, growth, respiration and subrogation of the dominant species in nature. (Holste, and pecks, 2006). Few studies, however, exist on the density of A. clausi and its mass culture for aquaculture purposes in laboratory or hatchery conditions at different salinities.

Various authors have attempted to mass culture different species of copepods most of such research has been made in temperate water. Zillioux (1969) was the first researched to work on planktonic copepods culture. Heinle (1970) conducted culture experiments on *Oithona* Spp. Merrylal James and Martine Thompson (1986) have experimental the culture of brackish water cyclopods and used the mariculture hatchery system. Recently marine copepod culture was successfully maintained by stottrupand norsker (1997) and Payne and ripping ale (2000). In line with the researchers conducted earlier the present attempt was made on the culture of copepod, *Oithona rigida* under laboratory conditions. In the present investigation we have demonstrated the mass culture of *Oithona rigida.*

MATERIALS AND METHODS

Algal Culture:

Micro algal culture was separately maintained for copepod feed. Phytoplankton sample were collected from Vellar estuary using the plankton net (32µm) and live cell of *chlorella vulgaris* and *Skeletonema costatum* were isolated by centrifugation and then stocked with separately in 100ml conical flask containing convey medium. (Stachowitsch et al. 1990).

Brood copepod collection

Copepod sample was collected from the Vellar estuary using plankton net (158) µm mesh size were collected during full moon time and then sample were immediately transported to laboratory and then thoroughly rinsed to reduce the contamination from unwanted organisms. The collected copepods were identified under microscope using the key of (Kasturirangan 1963). Transparent fiberglass tank of 25-Litre capacity was used for culturing *Oithona rigida*. Rearing containers were covered with nylon cloth to prevent excessive evaporation. Estuary water from the natural water source where the animals occur in the field was used. It was filtered through a membrane filter (pore size greater than 1µm) and the contamination of the rearing tank was reduced by frequent water exchange. Then, the copepods were separately cultured under four salinity levels (15,25, 35,45‰) in 5 L carboys containers and mass cultured were done with same salinity level in 15 L fiberglass tanks over 19 days period.

The copepods fed daily with a mixture of two algal diets including *Chlorella vulgaris* and *Skeletonema costatum* in a ratio of 1:1 to give a final density at concentration 40×10^3 cells mL^1 that measured by haemocytometer. Copepods were cultured at 25-26 °C and 12h L: 12h D (Light: Dark) photoperiod. Aeration was provided for small and large experimental treatments. For 15 L containers, the aeration was provided centrally near the 1 bottom of the carboys using a glass pipette with an aperture of 1.5 mm controlled to give a bubble of air one to three times per second. For 5 L tanks, aeration was provided by an air stone and its intensity was strong enough to circulate the water in the tanks without causing excessive turbulence. Oxygen concentrations were regulated at 5.8-6.1 mg LG1. For water exchange, 25-30 % of water volume was approximately exchanged every three days using a siphon with a 20 µm mesh attached to the end and new seawater that had been pre-adjusted to desired salinity was added. For all experiments, three replicates were set up for each treatment. The stock cultures were harvested at every 19 days finally the adult and late stages of copepods remaining in the washer were used to restart. Stock culture or used as feed for rearing the fish larvae.

RESULT

Water quality management

The water quality parameters were maintained for culture of *Oithona rigida* with the range of temperature, Salinity, pH and dissolved oxygen: 25^0C – 26^0C, 15, 25, 35, 45‰, 7- 8.5 and 4 - 7.5 respectively (**Table: 1**).

Table: 1 Water quality parameters during the culture period

S.No	Parameter	Range
1	Temperature	25-26^{0}c
2	Salinity	15,25,35,45‰
3	pH	7-8.5
4	Dissolved oxygen	4-7.5

Population density of copepod

In the present study copepod culture has been found to be optimal under laboratory condition over the 19 days in the way of systematic production with the average of 1,536 nauplii, 603 copepodids and 225 adults per liter. The maximum density of *O.rigida* was recorded as 2,625 nauplii, 2,110 copepodids and 1, 987 adults per liter.

The candidate species *O.rigida* had a generation period of 17-19 days with depended upon the temperature and the availability of food experiment in laboratory culture indicated that a 19 days culture cycle was sufficient for maximum copepod density. The maximum production of nauplli was attained on 17 days of culture and it noticed that the nauplli production decreased from the 18thday on wards. The daily production of copepod is given in figure 1.The newly hatched nauplli and the adult copepod were harvested from the cultures and stocked directly in to larval rearing tanks.

The growth curve of *Oithona rigida* four different combinations of salinity were not show similar response to all the treatment (**Figure: 2a, b, c, d**). In the present study the maximum growth was observed only medium salinity 35 ‰. The low salinity level of 15 ‰ the growth of O.rigida is affected. At the under medium salinity level of 25‰ generally showed limited growth for *O.rigida* was not effect on growth. At the high salinity level of 45‰ affect the growth in O.rigida. During the culture period the following temperature were maintained 25-26 °C. The abiotic parameter salinity and temperature have been reported to produce stress to plankton and theses stress conditions disrupt the growth of plankton.

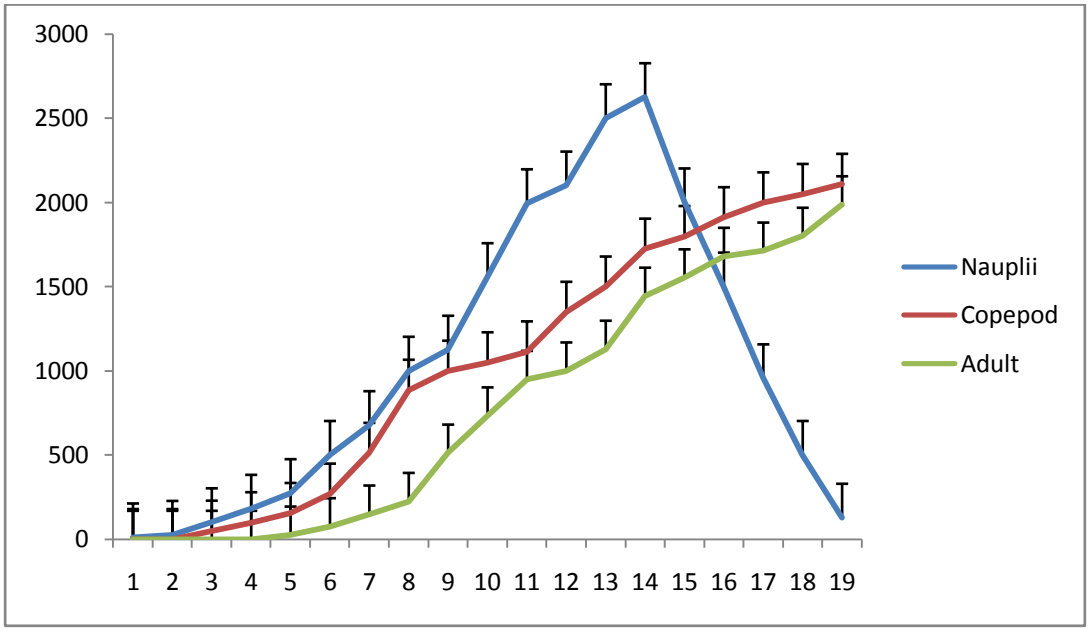

Figure 1: Daily production of copepod, Oithona rigida

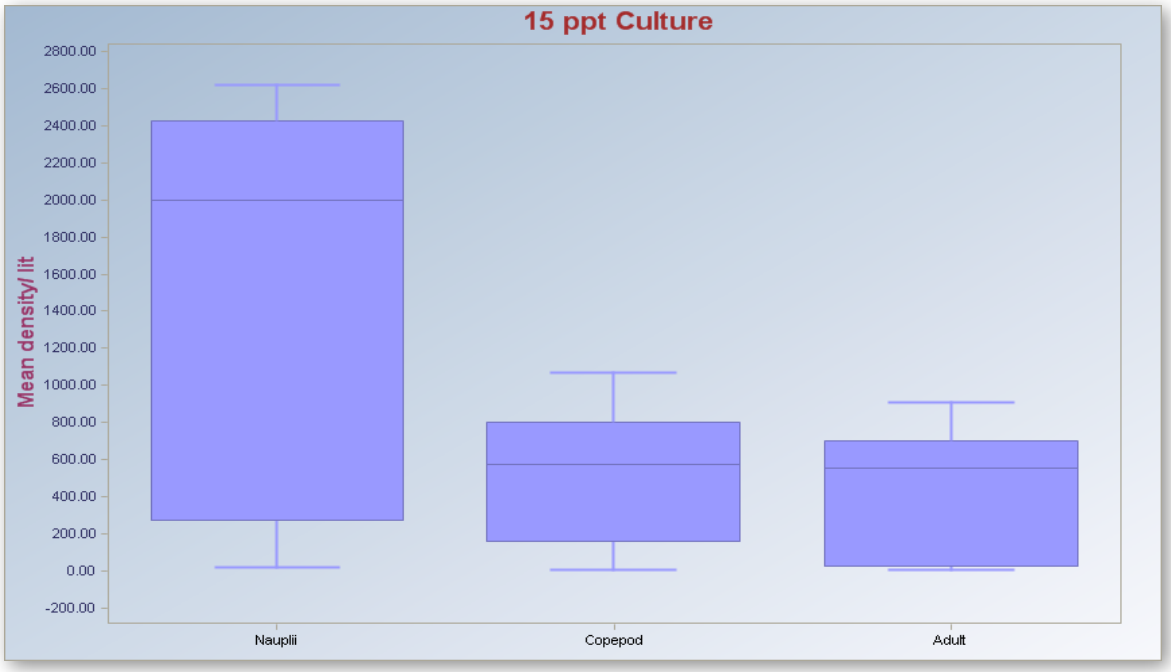

Figure: 2a Boxplot diagram shows the 15 ppt salinity range of culture growth level of copepod.

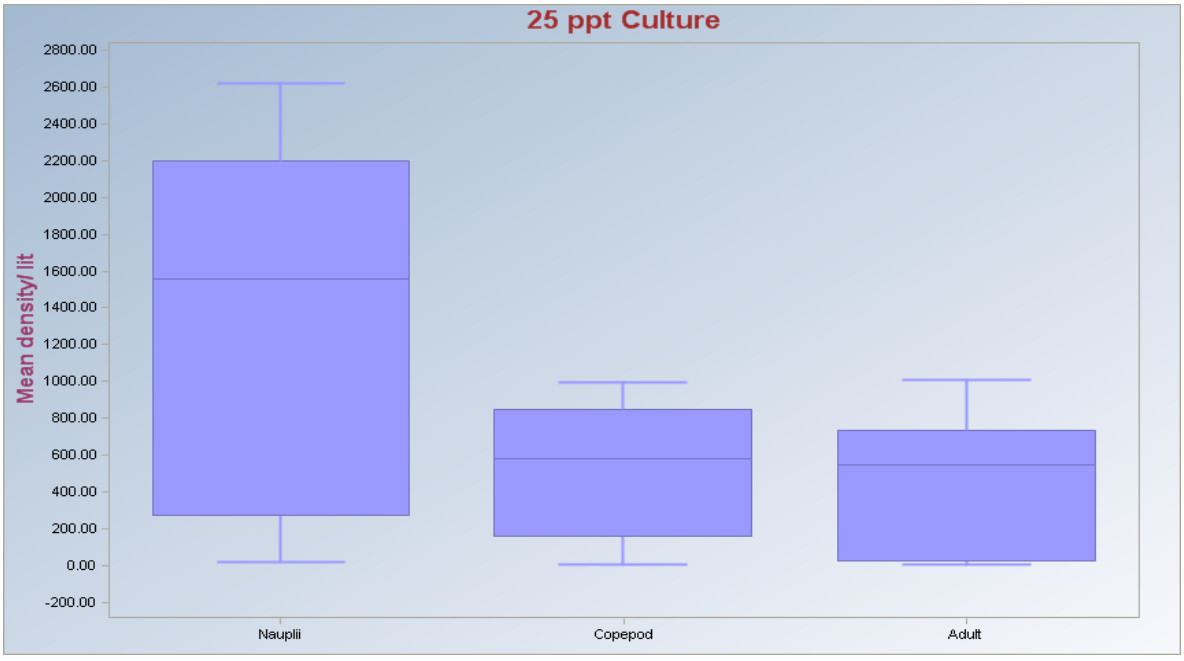

Figure: 2b Boxplot diagram shows the 25 ppt salinity range of culture growth level of copepod.

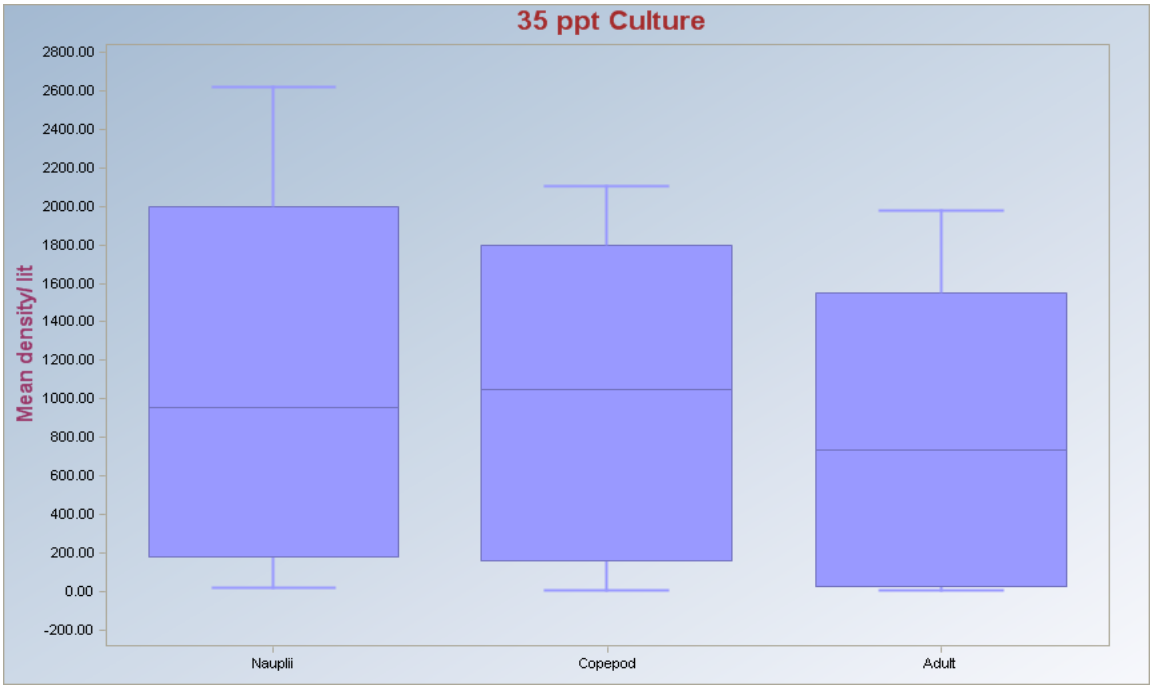

Figure: 2cBoxplot diagram shows the 35 ppt salinity range of culture growth level of copepod.

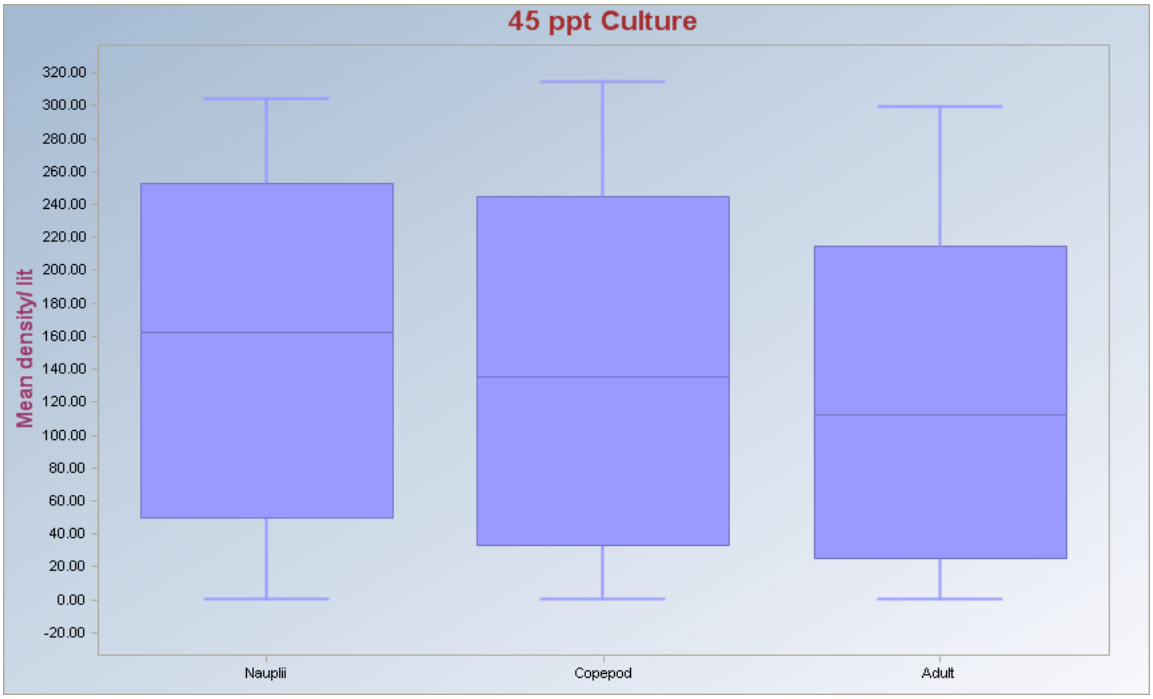

Figure: 2d Boxplot diagram shows the 45 ppt salinity range of culture growth level of copepod.

DISCUSSION

The nutritional superiority of copepods (for marine fish larvae) to traditional live feed like the rotifers *Brach onus plicatilis* and *Artemia* nauplli is well-established Besides being the natural live pray for marine larvae fish, copepods are a rich source of phospholipids, of essential high unsaturated fatty acid(HUFA) and of normal antioxidants (Bell et al.,2003). Copepod nauplli have been shown to be a highly advantageous food source for larval fish and hence the culture copepods and harvest their nauplli. When larval ornamentals first begin to feed, the larvae are small and consumption of a suitable food is critical for healthy development.

Copepod nauplli are small enough for first feeding, and they offer a higher nutritional content to ornamental finfish larvae. The cyclopoid copepods of ten well adapted to with seasonal fluctuations in salinity variation under natural conditions. Maximizing copepod productivity is the major goal for aquaculture purposes and salinity conditions used for culture are likely to affect productivity. It is often difficult to define salinity threshold for estuarine species, as different species may adapt to different salinities at various stages of their life history due to their habitat variations and it is likely to be species specific, or life-stage specific. Fecundity of copepods is influenced by the density of breeding females and nauplli, food quality and quantity, temperature, salinity, turbulence, stocking density, cannibalism of nauplli by adult and higher copepodite stages, culture tank size and shape, water quality, sex ratio and female longevity.

The cyclopoida copepod *O.rigida* is the most commonly occurring species in Parangipettai coastal water and which has the capacity to grow fast and breed continuously with high reproductive capacity. The present culture method is different from the other workers, in our system only adult copepods were used to restart the culture. Egg and nauplli were not used due to the problem in separation. In the present experiment individuals of adult male and female copepods of the genus O.rigida were stocking in culture tanks and the mating occurred the pairs. And after matting the eggs were produced with egg sacs and nauplli were released with 24 hours. The present study is similarly to the work of schipp et al., (1999).But varied from the earlier work of Stottrup et al., (1986) stated that the copepod culture was started from the separated eggs of culture animals. In the present observation the maximum output of 2,625 nauplli per liter was recorded followed by 2,110 copepodites per liter and the adults of 1,987 per liter. For the successful aquaculture practices attempts may also be made to develop intensive culture technique for other species viz. *Acartia* sp and Paracalanus, Eurytemora, Pontella, Lebidocera, etc. The present culture method described the economically practicable and more number of copepod O.rigida can be used as a feed for the mass rearing of fish larvae.

From the results of this study, it can be concluded that *Oithona rigida* could survive at a very broad range of salinities (15-45 ‰ as achieved in the current study). During copepod culture, the system produced average nauplii density was 19.023 org/1, copepodids 6.155 org/1 and adults 2.936 org/1 per liter were produced. Based on the findings of this study, to achieve maximum density of *O.rigida* culture for aquaculture purposes, it could be kept and cultured at an optimum salinity of 35 ‰.

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