International Journal of
Recent Innovations in Academic Research

Volume-1, Issue-1, November 2017, Page No: 23-28 ISSN : 2635-3040

ALGAL GROWTH IN INDOOR CULTURE OF *LITOPENAEUS VANNAMEI* (BOONE, 1931) HATCHERY WITH REFERENCE TO TEMPERATURE AND LIGHT

Siva Reddy, K.V. and Ramesh Babu, K.
Department of Marine Living Resources
Andhra University, Visakhapatnam, Andhra Pradesh, India
Corresponding author E-mail: kvsivareddy1@gmail.com

Abstract: Phytoplankton comprises the base of the food chain in the marine environment. It is an indispensable food source in the commercial rearing of many cultivable species. In the present study culture of algae carried out in Indoor culture system. During culture of microalgae environmental parameters like light and temperature was alter for every two days. After observation against temperature changes from 20^0C to 35^0C, maximum growth was at 26^0C and 27^0C i.e. 5.9 million cells/ml and 6.67 million cells/ml. The cell growth is minimum at 20^0C and 35^0C in all the containers-small flask, big flasks and carboys (R^2=0.727; P<0.0001; R^2=0.697; P<0.0001; R^2=0.794;P<0.0001) respectively. Similarly light is adjusted from 500 to 5000 lux maximum cell density was observed at 2000 lux as 5.7 million cells/ml, 6.29 million cells/ml, 5.57 million cells/ml in all the containers-small flask, big flasks and carboys (R^2= 0.587; P<0.0003; R^2= 0.606; P<0.0003; R^2=0.704; P<0.0003) respectively. These results in the formation of peak which indicates that maximum growth has been observed up to 6.29 million cells/ml at optimum light intensity which is 2000 lux, minimum growth was observed at 500 lux and 5000 lux.
Keywords: Microalgae light, temperature and cell density.

Citation: **Siva Reddy, K.V.** and Ramesh Babu, K. 2017. Algal growth in Indore Culture of *Litopenaeus vannamei* Hatchery with reference to Temperature and Light. Int. J. Rec. Innov. Acad. Res., 1 (1): 23-28.

Introduction

Microalgae are the primary producers and acts as precursors for any aquatic food chain and maintain in the flow of energy from one stage to other (Gopinathan, 2009). According to Gopinathan (1996) hatchery success of the oysters species, crustacean species sea cucumbers species and fish species majorly depends on the suitable microalgae. While choosing the microalgae as feed for any hatchery practices the parameters like size, environmental conditions and nutritional profile of algae taken into consideration (Helm *et al.*, 2004).

Culture of microalgal species is cost effective technology and one of the promising aspects of the hatchery operations. To produce one dry kilogram of microalgal biomass the estimated cost of feed ranges from $ 100 to $ 400 (Wikfors, 2000). Research on mircroalgal cultivation and biomass of the commercial products has gained much importance in the field aquaculture from last 5-6 decades with reference to larval feed as one of the target point (Spolaore *et al.*, 2006; Cardozo *et al.*, 2007; Eriksen, 2008; Satoh *et al.*, 2013). Hence in this study we emphasized the environmental conditions like temperature

and light on algal growth in indore culture system of *L. vannamei* hatchery.

Material and Methods

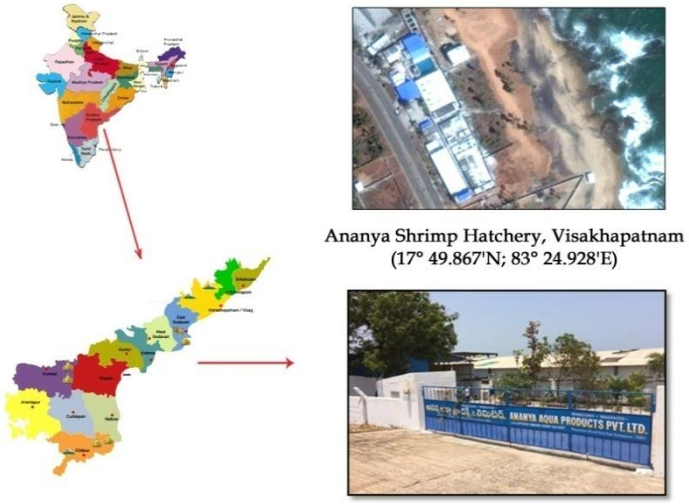

Figure 1. Study area map

The present research work was carried out in the Marine Living Resources Department, Andhra University, Visakhapatnam (170 43. 0.25 N; 830 19.0.43 E) and facilities at Ananya shrimp hatchery, Visakhapatnam (170 49.867 N; 830 24.928 E) for conducting experiments on commercial scale during the year 2013-2015 **(Figure 1)**.

Micro algal culture

For studies on live feed culture, experiments were conducted on algae culture. The algal culture was examined in three different flasks like small flask, big flask and carboys. The culture water was enriched with medium as described by (Guillard, 1975-Guillard's F/2 medium) for indoor culture. During the experimentation the treated water used for the algal cell density estimation was subjected to autoclave sterilization to minimize the algal cells damage and contamination.

For studies on effect of temperature on algal growth, different temperature ranges from 20-35 ^{0}C was maintained. Similarly effect of light on algal growth different light intensity ranged from 500-5000 lux was maintained and the intensity of light was measured using lux meter. Daily all the algal samples were observed under the microscope and only good quality algae in active dividing state were allowed for further culture and larval feeding. Algal cell density regularly was estimated by using a haemocytometer.

Results and Discussion

Temperature effect on algal growth

Phytoplankton comprises the base of the food chain in the marine environment. It is an indispensable food source in the commercial rearing of many cultivable species. In the present study culture of algae carried out in Indoor culture system.

During culture of micro algae environmental parameters like light and temperature was alter for every two days. After observation against temperature changes from 20^{0}C to 35^{0}C, maximum growth was at 26^{0}C and 27^{0}C i.e. 5.9 million cells/ml and 6.67 million cells/ml. The cell growth is minimum at 20^{0}C and 35^{0}C in all the containers small flask, big flasks and carboys (R^2=0.727; P<0.0001; R^2=0.697; P<0.0001; R^2=0.794; P<0.0001) respectively. The results were shown in **Figures 2, 3 and 4.**

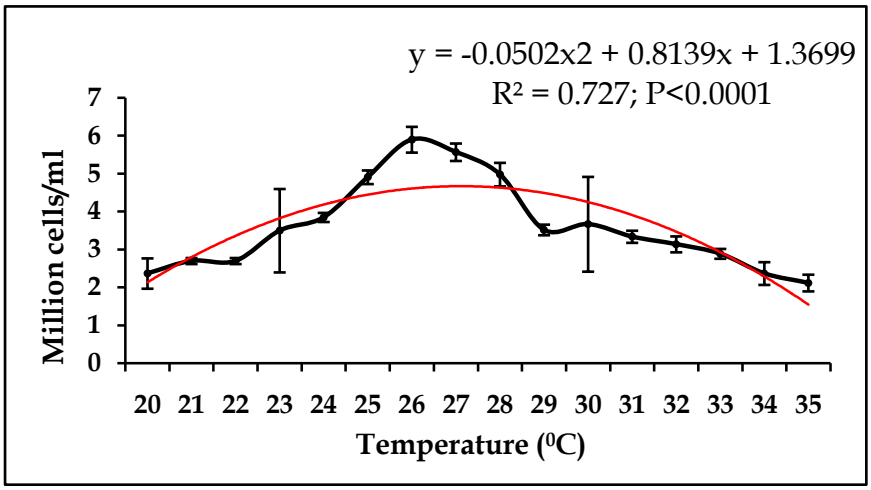

Figure 2. Algal growth in small flask at different temperatures

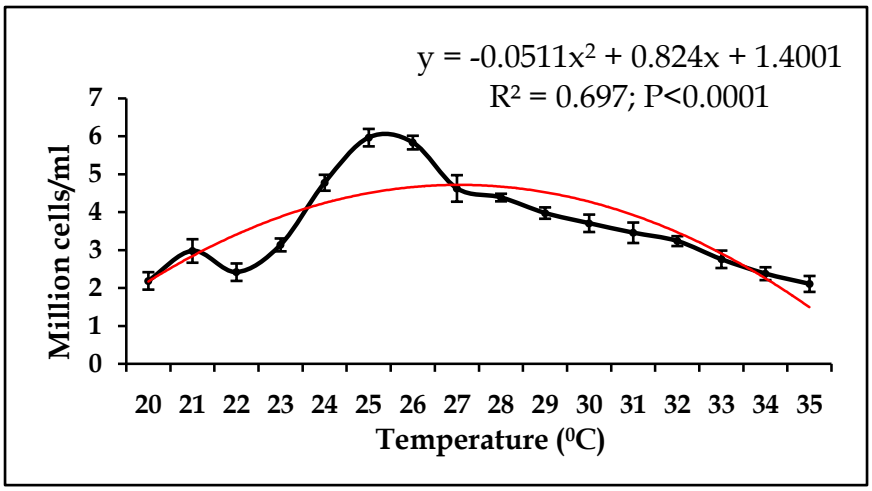

Figure 3. Algal growth in big flask at different temperatures

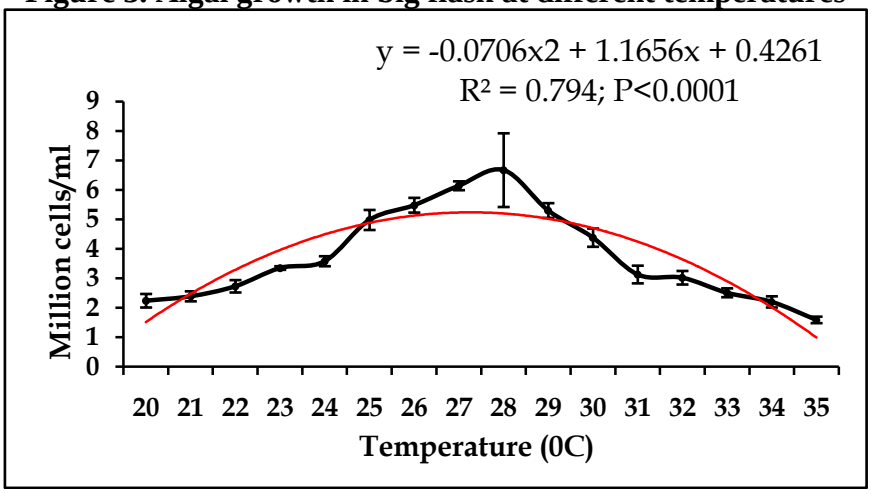

Figure 4. Algal growth in carboys at different temperatures

Microalgae growth response towards different temperatures were compared by Ukeles (1976) and he suggested that the optimum temperature suitable for growth is differ from species to species and also depends on the prevailing environmental

conditions to some extent. In the present study attention was paid on to environmental parameters such as temperature, light and nutritional supplements to the algal culture on their cell counts and multiplication.

Generally the optimal temperature required for the phytoplankton culture ranged between 20 to 24^{0}C. Commonly culturing species of microalgae can tolerate the temperatures in between 16 to 27^{0}C. When temperature below 16^{0}C the growth of the microalgae reduced and if it will reach more than 30 ^{0}C leads to cell damage and sometimes lethal for major number of species Temperature will influence not only on cell count of algae but also the percentage of nutritional content i.e. decreased at low temperatures.

Effect of light on algal growth

Similarly light is adjusted from 500 to 5000 lux maximum cell density is observed at 2000 lux in all the containers as 5.7 million cells/ml, 6.29 million cells/ml, 5.57 million cells/ml in all the containers small flask, big flasks and carboys (R^2= 0.587; P<0.0003; R^2= 0.606; P<0.0003; R^2= 0.704; P<0.0003) respectively. These results in the formation of peak which indicates that maximum growth has been observed up to 6.29 million cells/ml at optimum light intensity which is 2000 lux, minimum growth is observed at 500 lux and 5000 lux **(Figures, 5, 6 and 7).**

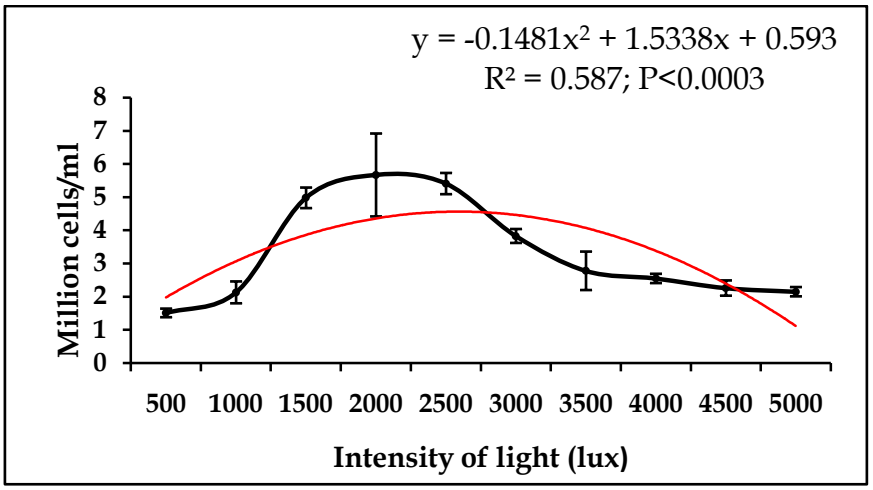

Figure 5. Algal growth in small flask at different light intensity

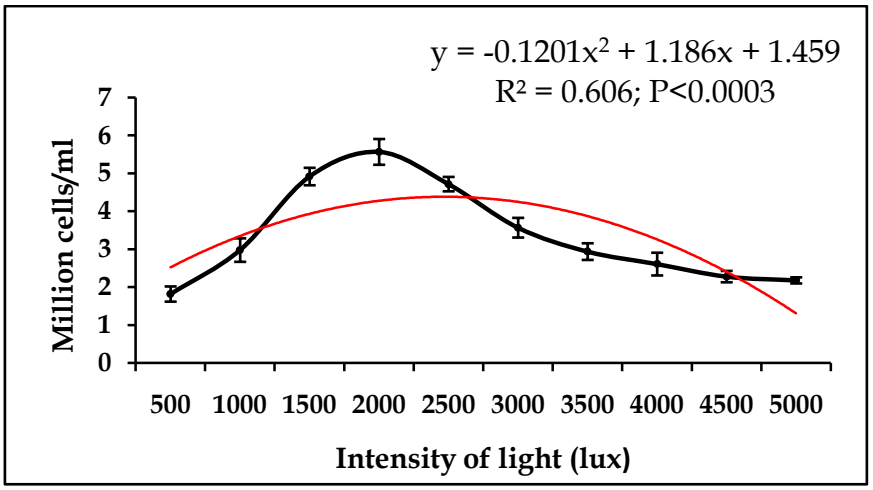

Figure 6. Algal growth in big flask at different light intensity

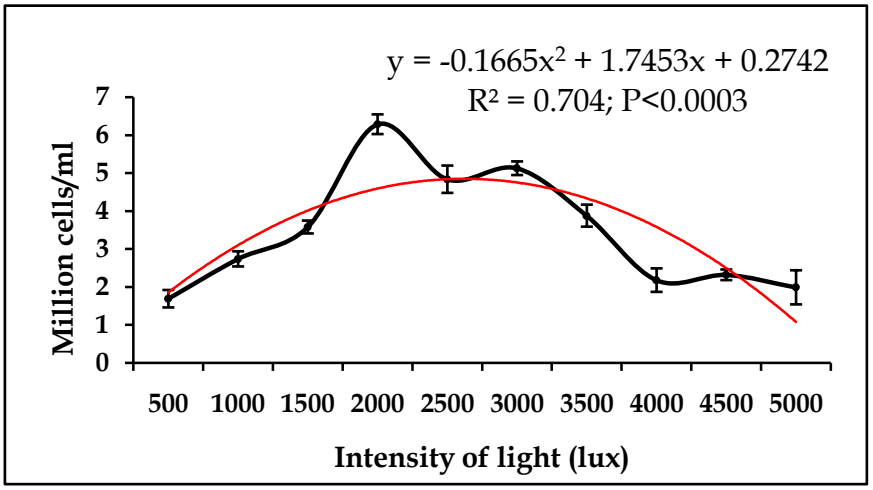

Figure 7. Algal growth in carboys at different light intensity

Another important aspect of the present study is effect of light on algal growth for these experiments were conducted on algae *Chaetoceros* species at indoor system. Growth was evaluated at different intensities of light; it has been observed that the optimum growth was recorded at 2000lux. The results of present study on algal growth was well in agreement with those studies were conducted by Raj Kumar and Babu (2015).

Light is considered as one of the prominent factor that drive the photosynthesis process by converting nutrients into algal biomass. Depth of the culture in culture flasks and density of algal cells are the factors which influence the usage of light during experimentation time (Richmond *et al.*, 1980). Escobal (1983) recommended light intensity for optimal microalgae photosynthesis process ranged between 2, 500 to 5, 000 lux with maximum of 10, 000 lux. For stock culture of *Thalassiosira pseudonana* the recommended light intensity ranged between 3, 500 to 4, 500 by (Guillard, 1975).

Acknowledgements

The corresponding author express his sincere gratitude to the funding agency Department of Science and Technology (DST-INSPIRE Fellowship-IF 120 322), New Delhi and also thanks to the Hatchery Manager Dr. P.V. Nageswara Rao, Ananya Shrimp Hatchery Pvt. Ltd as well as Head, Marine Living Resources Department for providing facilities during course of this work.

References

Cardozo, K.H., Guaratini, T., Barros, M.P., Falcao, V.R., Tonon, A.P., Lopes, N.P., Campos, S., Torres, M.A., Souza, A.O., Colepicolo, P. and Pinto, E. 2007. Metabolites from algae with economical impact, Comparative Biochemistry and Physiology Part C: Toxico. Pharma., 46: 60-78.

Eriksen, N.T. 2008. The technology of microalgal culturing. Biotech. Letters., 30: 1525-1536.

Escobal, P. 1993. Inside ultraviolet sterilizers. Aquarium Fish Magazine, January 1993:52−63.

Gopinathan, C.P. 1996. Live-feed culture-Microalgae. Bull. Central Mar. Fish. Res. Inst., 48: 110-116.

Gopinathan, C.P. 2009. Micro algae culture as live feed. CMFRI-Winter School Course Manual on Recent advances in breeding and larviculture of marine finfish and shellfish. Central Mar. Fish. Res. Inst. Bull., 61-65.

Guillard, R.R.L. 1975. Culture of phytoplankton for feeding marine invertebrates. In: Smith, W.L., Chanley, H.H. (Eds.)., Culture of Marine Invertebrate Animals. Plenum Press, New York, New York. pp: 29-60.

Helm, M.M., Bourne, N. and Lovatelli, A. 2004. Hatchery culture of bivalves: A Practical Manual, FAO Fisheries Technical Paper Number 471, Rome, Italy. 200 pp.

Raj Kumar, G. and Babu, D.E. 2015. Effect of light, temperature and salinity on the growth of *Artemia.* Int. J. Eng. Sci. Inven., 4(12): 07-14.

Richmond, A., Vonshak, A. and Arad, S. 1980. Environmental limitations in outdoor production of algal biomass. In: Shelef, G., Soeder, C.G. (Eds.), Algae Biomass. Elsevier/North Holland Biomedical Press, New York, pp: 65-72.

Satoh, A., Ichii, K., Matsumoto, M., Kubota, C., Nemoto, M., Tanaka, M., Yoshino, T., Matsunaga, T. and Tanaka, T. 2013. A process design and productivity evaluation for oil production by indoor mass cultivation of a marine diatom, *Fistulifera* sp. JPCCDA0580. Biores. Tech., 137: 132-138.

Spolaore, P., Joannis-Cassan, C., Duran, E. and Isambert, A. 2006. Commercial applications of microalgae. J. Biosci. Bioeng., 101: 87-96.

Wikfors, G.H. 2000. Microalgal culture. In: Stickney, R.R. (Eds.), Encyclopedia of Aquaculture. John Wiley and Sons, Inc, New York. pp: 520-528.