Pak. J. Sci. Ind. Res. 2010 **53** (2) 89-91

Culture of *Ceriodaphnia cornuta*, Using Chicken Manure as Fertilizer: Conversion of Waste Product into Highly Nutritive Animal Protein

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(received August 6, 2009; revised January 26, 2010; accepted February 10, 2010)

Abstract. For finding a cheap and suitable feed for culture of *Ceriodaphnia cornuta* studies were carried out for 21 days using chicken manure as fertilizer whereupon *C. cornuta* population ranged between 50 ± 2 and 10,232 ± 202 Ind./L. (individuals/L). The culture peaked on the 17th day producing the maximum density of 10,232 ± 202 Ind./L. Thus chicken manure can be used as a fertilizer for mass culture of cladocerans, specially *C. cornuta*.

Keywords: culture, chicken manure, *Ceriodaphnia cornuta*, live feed

Introduction

The need for large quantities of live feed organisms in aquaculture and the increasing need for valorizing organic wastes, such as animal manure and agro-industrial residue, have been the major initiatives for research on the culture of live feed organisms (DePauw *et al*., 1980). Chicken manure is a waste produced in poultry farms in large quantities and is cheap. According to Banerjee *et al.* (1979) it is a complete fertilizer with both organic and inorganic fertilizer characteristics. Ray and David (1969) opined that chicken manure-fertilized medium produced a large population of cladocerans quicker than cattle manure and the plankton biomass increased with the increase of its dosage. The bacteria (gram positive and gram negative) and protozoans (*Paramaecium* sp.) produced in the fertilized medium form the suitable feed for mass production of this species. Different culture techniques are being developed to increase yield of cladocerans by employing different waste organic products as feed sources (Tay *et al*., 1991; Punia, 1988; Shim, 1988). Although *Artemia* nauplii (Versichele *et al.,* 1986) and rotifers (Pourrito, 1986) are common live feed organisms which are mass cultured for hatchery use, there is growing interest for the production of Cladocera (Adeyemo *et al.,* 1994). But availability of live feed is still a bottle neck in commercial seed production (Rao and Tripathi, 1993). A variety of artificial pelletized feed are available to rear the voracious larval stages of cultivable species which are not preferred as compared to live feed (Sumitra, 1987).

As the cladocerans are considered to be suitable live feed for fish larvae, they were mass cultured successfully by many investigators using different cheap organic waste products, (Golder *et al.*, 2007; Shrivastava *et al.*, 2006; Sivakumar, 2005; Suresh Kumar, 2000). Due to the smaller size and locomotive behaviour, *C. cornuta* has become the most preferable species of the fish larvae (Suresh Kumar, 2000).

The aim of this paper is to demonstrate the feasibility of maintaining culture for mass production of *Ceriodaphnia* solely on chicken manure and to provide practical guidelines to run such cultures.

Materials and Methods

Chicken manure was collected from a local broiler chicken shop and was dried for 2 days to remove the moisture and then in plastic jars for further use. Chicken manure was micronized by grinding and the required quantity was dissolved in distilled water to get suspension of 400, 700 and 1000 ppm and was used to fertilize culture medium. Chicken manure suspension of 700 ppm concentration supported higher density of *C. cornuta* than other concentrations during preliminary trials carried out in 1 L beaker and was used to fertilize the medium for mass culture in 50 L tanks. Zooplankton sample was collected from Chetpet Freshwater Pond, Chennai India and was brought to the laboratory with the least disturbance. The adult *C. cornuta* were separated using binocular dissection microscope based on the key characters outlined by Suresh Kumar and Sivakumar (2004).

The experimental aquarium tanks of 50 L capacity were filled with 40 L of filtered water and were fertilized with chicken manure at the rate of 700 ppm. The tanks were arranged in triplicate and after 4 days, *C. cornuta* were inoculated in each experimental tank at the rate of 50 Ind./L (individual per litre) containing both adults and neonates. The culture experiment

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was conducted for 21 days. Water change was carried out after every 3 day interval by removing 50% of the water. Food was administered as a function of population density every 3rd day using the formula of DePauw *et al*. (1981):

$$Y = [(\log 10^N/10) - 0.2] \times V \times d.$$

where:

Y = quantity of chicken manure
N = population density (Ind. /L)
V = volume of culture (L)
d = number of days for which the food is to be given

The culture water used in all experiments was tap water, previously aerated for 24 h to dechlorinate the water (Ivleva, 1973). To avoid anaerobic conditions in the medium, the sediment (unconsumed food, faeces and pseudofaeces) was siphoned from the bottom three times a week. Excessive fouling was also removed from the walls of the tanks. Population density was estimated by counting samples, taken at random with 1 L beaker, after mixing the culture volume. Subsamples of 100 mL and then 10 mL were drawn from these samples. Samples were immobilized using alcohol and counting was carried out using Sedgwick Rafter cell under a binocular dissection microscope. Results were expressed as number of individuals per litre (Ind./L).

Results and Discussion

In the current study, the highest population of *C. cornuta* was observed in the tanks fertilized with 700 ppm concentration of chicken manure which suggested that 700 ppm might be the optimum level. Nutrients beyond the optimum level reduced population and this may be due to the rapid degradation of high nutrient content in the medium, resulting in increased ammonia and growth of pathogenic microbes (Adeyemo *et al.,* 1994). Tucker *et al.* (1979) and Doyle and Boyd (1984) reported that water quality deteriorated in the systems receiving high organic input or commercial feed. Similarly, concentration of nutrients below the optimum level also resulted in reduced population of *C. cornuta* which may be due to insufficient microbial and protozoan populations. Reduced population in low concentration may also be due to the lack of sufficient organic compounds that are required for the growth and survival of the live feed organisms.

During the culture period, the *C. cornuta* population ranged between 50 ± 2 and 10, 232 ± 202 Ind./L. The culture peaked on the 17th day producing a maximum density of 10, 232 ± 202 Ind./L (Fig.1). Compared to the previous reports, higher population of *C. cornuta* was recorded in the present study at 700 ppm. Suresh Kumar (2000) and Sivakumar (2005)

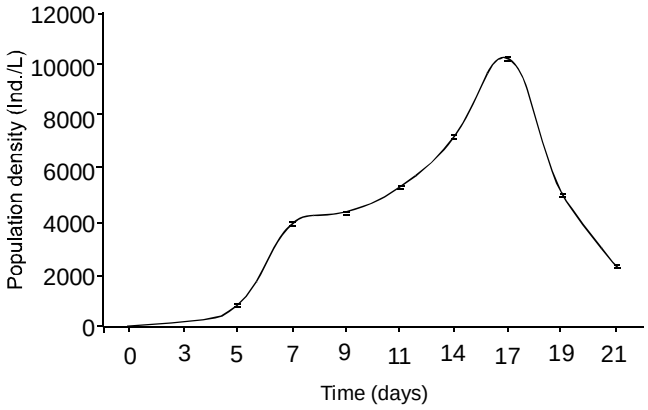

Fig. 1. Population density of *C. cornuta* (Ind./L) on different days during the culture (mean ± SE).

reported 5817 Ind./L and 6247 Ind./L in chicken manure and mixed algae mixture, respectively. Using a mixture of organic manure (cattle manure, poultry droppings and mustard oil cake), Shrivastava *et al.* (2006) cultured *C. cornuta* at a maximum density of 1930 Ind./L. Ray and David (1969) opined that chicken manure-fertilized medium produced a large population of cladocerans quicker than cattle manure; the plankton biomass increased with the increase of dosage. An absolute prerequisite to maintain cultures is to renew part of the culture water at regular intervals, to ensure a permanent good water quality. Our experiments prove that chicken manure is a suitable feed for *Ceriodaphnia.* It has many advantages in comparison to other live feeds (e.g., microalgae): it is available in large quantities, it can be purchased easily at low price; it can be used directly after drying, it can be stored for longer periods, it is easy to dose and it has none of the problems involved in maintenance of algal stocks and cultures (Sivakumar, 2005). It has been reported that a wide range of live and inert feeds can be successfully used in culturing live feed organisms (Sorgeloos and Persoone, 1975). A cheap feed, available worldwide, will be more helpful and will reduce the cost of expenditure on live feed culture, thereby reducing the cost of seed production in hatcheries. *Ceriodaphnia* can be grown to a high density on chicken manure. However, a necessary prerequisite is the exact dosing. The quantity of feed used in our experiment was based on the estimation of population density (DePauw *et al*., 1981).

Overfeeding causes high mortality due to unfavorable conditions for culture. Frequent addition of small quantities appears to be the best regime. The maximum interval between the two consecutive feedings should not exceed 2-3 days. The more frequent the administration of appropriate small doses, the lower the risk of overfeeding (DePauw *et al*., 1981). This prac-

tice also decreases the amount of culture medium which must be renewed at regular intervals. Under constant culture conditions, a feeding programme can be worked out as a function of the expected population development. By enriching the medium with chicken manure the culture revives in a few days (Muthupriya and Altaff, 2009). Thus the present study reveals that dehydrated chicken manure-fertilized medium at 700 ppm appears to be a suitable medium for successful culture of *C. cornuta* to high density.

Acknowledgement

The authors are thankful to ICAR-NAIP for providing funds to carry out this research work under the project F. No.1 (5)/ 2007-NAIP, dt. 22 Aug. 2008.

References

Adeyemo, A.A., Oladosu, G.A., Ayinla, A.O. 1994. Growth and survival of fry of African catfish species, *Clarias gariepinus* Burchell, *Heterobranchus bidorsalis* Geoffrey and *Heteroclarias* reared on *Moina dubia* in comparison with other first feed sources. *Aquaculture*, **119:** 41-45.

Banerjee, R.K., Ray, P., Singit, G.S., Dutta, B.R. 1979. Poultry droppings - its manurial potentiality in aquaculture. *Journal of Inland Fishery Society of India*, **2:** 94-108.

DePauw, N., De Leenheer, L. Jr., Laureys, P., Morales, J., Reartes, J. 1980. Cul-pisciculture d'algues et d' invertebres sur dechets agricoles. In: *La Pisciculture Enetang,* R. Billard (ed.), pp. 189-214, INRA Publications, Paris, France.

DePauw, N., Laureys, P., Morales, J. 1981. Mass cultivation of *Daphnia magna* Straus on rice bran. *Aquaculture,* **25:** 141-152.

Doyle, K.M., Boyd, C.E. 1984. The timing of inorganic fertilization of sunfish ponds. *Aquaculture*, **37:** 169-177.

Golder, D., Rana, S., Paria, S.D., Jana, B.B. 2007. Human urine is an excellent liquid waste for the culture of fish food organism *Moina micrura*. *Ecological Engineering,* **4:** 326-332.

Ivleva, I.V. 1973. *Mass Cultivation of Invertebrates: Biology and Methods,* Translated from Russian, 148 pp., Israel Program for Scientific Translations, Jerusalem, Isarel.

Muthupriya, P., Altaff, K. 2009. Mass culture of *Ceriodaphnia cornuta* in chicken manure fertilized medium. *Journal of Experimental Zoology India*,**12:** 157-158.

Pourrito, R. 1986. Les rotifers: bilogie. In: *Aquaculture,* G. Barnabe (ed.), vol. **1**, pp. 201-222, Lavoisier, Paris, France.

Punia, P. 1988. Culture of *Moina micrura* on various organic waste products. *Journal of Indian Fisheries Association*, **18:** 129-134.

Rao, K.J., Tripathy, S.D. 1993. A manual of giant freshwater prawn hatchery. *CIFA Manual Series*, **2:** 50 pp.

Ray, P., David, A. 1969. Poultry manure as potential plankton producer. *Labdev Journal of Science and Technology*, **7:** 229-231.

Shim, K.F. 1988. Mass production of *Moina* in Singapore using pig manure. *World Aquaculture,* **19:** 59-60.

Shrivastava, A., Rathore, R.M., Chakrabarthi, R. 2006. Effects of four different doses of organic manures in the production of *Ceriodaphnia cornuta*. *Bioresource Technology*, **97:** 1036-1040.

Sivakumar, K. 2005. Freshwater Fish and Prawn Larval Rearing Using Indigenous live-feed. *Ph. D Thesis*, pp. 1-147, University of Madras, India.

Sorgeloos, P., Persoone, G. 1975. Technological improvements for the cultivation of invertebrates as food for fishes and crustaceans. II. Hatching and culturing of the brine shrimp, *Artemia salina* L. *Aquaculture*, **6:** 303-317.

Sumitra, V. 1987. Cultivation of live food organisms status and scope in India. In: *Advances in Aquatic Biology and Fisheries*, Natarajan, H. Suryanarayanan and P.K.A. Azis, (eds.), Prof. N. Balakrishnan Nair, Felicitation Volume, pp. 239-249, Kerala, India.

Suresh Kumar, R., Sivakumar, K. 2004. Key to common cladocerans. In: *A Manual of Zooplankton*, Compiled for the National Workship on Zooplankton, Channai, K. Altaff (ed.), pp. 58-67, Unit of Reproductive Biology and Live Feed Culture, Department of Zoology, The New College, Chennai, India.

Suresh Kumar, R. 2000. Studies of Freshwater Cladocerans use as Livefood in Aquaculture. *Ph.D Thesis*, pp. 1-147, University of Madras, India.

Tay, S.H., Rajbanshi, V.K., Ho, W.H., Chew, J., Yap, E.A. 1991. Culture of cladoceran *Moina micrura* Kurz using agroindustrial wastes. In: *Proceedings of The Fourth Asian Fish Nutrition Workshop,* S.S. De Silva (ed.), pp.135-141, Manila, Phillipines.

Tucker, L., Boyd, C.E., McCoy, E.W. 1979. Effects of feeding rate on water quality, production of channel Catfish and economic returns. *Transactions of The American Fisheries Society,* **108:** 389-396.

Versichele, D., Leger, P., Lavens, P., Sorgeloos, P. 1986. Utilization d' *Artemia*. In: *Aquaculture Collective Techniques Documents,* G. Barnabe (ed.), pp. 239-258, Lavoisier, Paris, France.