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Mass Culture of Zooplankton, *Ceriodaphnia cornuta* on Animal Excreta

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***Daphnia* spp. is one of the important live feed usable in practical aquaculture that is present in ponds all over India. Enrichment of Daphnia is essential to promote Aquaculture Industry. Hence the present study was focused to study in mass culture of *Ceriodaphnia cornuta* using cow dung, goat pellets, chicken droppings and cow urine along with groundnut cake and superphosphate. Groundnut oilcake had the highest nitrogen (4.97%), phosphorus (0.15%) and potassium (0.73%). Among the animal wastes cow urine had the highest amount of nitrogen (1.93%) and potassium (1%), while chicken droppings had the highest amount of phosphorus (0.80%). The population of *Ceriodaphnia* varied significantly with animal excreta. The highest mean population was observed in chicken droppings slurry at 50g per 20 liters of water.**

Key words: Animal wastes, Zooplankton, Ceriodaphnia cornuta, Organic manures.

Use of manure in aquaculture supports the production of proteins using inputs of little nutrient value to man or livestock (Wohlfarth and Hulata, 1987). Inorganic fertilizers are expensive and their use by aqua farmers may be limited (Swift, 1993). Animal manures have a long history of use as a source of soluble phosphorus, nitrogen and carbon for algal growth and natural food production. Animal manures are often used to improve the primary production of the ponds and fish growth Nwachukwu, 1997; Knud-Hansen, 1998). Poultry and cattle manures with *Oreochromis niloticus* and *O. shiranus* in pond sand produced good results (Kamanga and Kaunda, 1998). Pig manures were tried in aquaculture in many areas (Hepher and Pruginin, 1982). Boyd (1982) reported that poultry manures triggered more production of phytoplankton in ponds than organic or inorganic fertilizers. The use of organic manures can be a good option for small- scale farmers. In addition, *Daphnia* spp. in general serve as a good bioindictor in aquatic ecosystem for testing pesticide residues and mineral pollutants, especially in agro urban ecosystems.

Zooplanktons serve as prime natural food in rearing of larval fish (Lubzens *et al.*, 1987) post-larval rearing and in maintaining better water quality in the fish culture system fed with exogenously produced live food organisms (Jana and Chakrabarti, 1993). It is of immense use in the culture and maintenance of ornamental aquarium fish by minimizing the use of artificial feed for keeping improved water quality. Several studies have been enacted on the mass culture of zooplanktons (*Daphnia, Moina, Diaphanosoma*) using some organic manures. Jana and Pal, (1985) have developed *in situ* method for mass culture of *Daphnia spp*. Using a mixture of cow manures, poultry droppings and mustard oil cake (1:1:1), Srivastava *et al*., (2006) found the dose of 2.104 kg m^{-3} to be optimum for the culture of *Ceriodaphnia cornuta*. Studies (Chakrabarti and Sharma, 2005) evidenced successful rearing of Indian carps and exotic carps, fed on exogenously produced mixed zooplanktons dominated by *Ceriodaphnia* sp. during early stages of development. Crustaceans, that often dominate the zooplanktons, are major herbivores. *Cladocera* are polyphagous feeders and find their food in the seston. Geller classified Daphnids, including the *Ceriodaphnia* , as fine mesh filter feeders (Geller, and Mueller 1981) and observed that zooplankton production on the waste was possible by passing the primary level of production. Manures supply N and P for utilization by algae and provide a substrate for zooplankton production; (Mims *et al.,* 1995). Poultry manure was found to release soluble salts continuously thus resulting in high production of plankton especially zooplankton (Sulochana Gaur and Gaur, 2007). *Ceriodaphnia* are closely related and morphologically similar to Daphnia, but are smaller and have a shorter generation time (USEPA, 1986). The aim of this study was to determine the effect of different animal excreta as media for the growth of *Ceriodaphnia cornuta.*

Materials and Methods

The freshwater cladoceran *Ceriodaphnia cornuta* was collected from Muthanna Lake, Coimbatore, Tamil Nadu. The collection was made in the early hours between 6.00 and 7.00 am to obtain a maximum number of species. A dip net

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was swiped through the surface water. An attempt was made to culture *C.cornuta* in the laboratory at 25º C in BOD incubator using sterilized ground water. Initially 50 organisms were isolated and inoculated into 20 liters of culture medium. Cultures were maintained in a (BOD) incubator at 25º C and a pH of 7.0 ± 0.5. Water was initially filtered through a fine plankton net (20 μm) and subsequently filtered through No.4 sintered disk filter (Borosil, USA) finally with No.1 Whatman filter paper to ensure that the medium contained no protozoan, ciliate cysts, eggs of other zooplanktons, etc.

Experiments were started with preparation of nutrient medium which was prepared by adding animal excreta in, groundnut oil cake and single super phosphate into a tub. Each tub was filled with 20 liters of water. Control was kept without any animal excreta and it had only groundnut oilcake and single superphosphate mixed with 20 liters of clean water.

Treatments

1, Control - (Without animal wastes) Groundnut oilcake (GOC)100g+Single super phosphate50g

2, Medium -Chicken droppings 50g+ Groundnut oilcake (GOC) 100g+Single super phosphate50g

3, Medium - Goat pellets 50g+Groundnut oilcake 100g+Single super phosphate50g

4, Medium - Cow dung 50g+Groundnut oilcake 100g+Single super phosphate50g

5, Medium - Cow urine 50 ml+ Groundnut oilcake 100g + Single super phosphate50g

All other treatments were added with equal quantity of animal excreta and single super phosphate and groundnut oil cake. In the case of treatments where animal manures were introduced, vigorous aeration was induced to allow escape of obnoxious gases. Fifty numbers *Ceriodaphnia* were inoculated in to each tub. From the day of inoculation, exchange of 10% of water was done every day. Physico- chemical characteristics of water were analyzed daily. Plankton population was estimated on daily basis.

Biochemical analysis of animal excreta

The excreta and oil cake were analysed before application using standard methods (AOAC, 1990). Analysis of dry matter was done by drying pre-weighed samples in an oven at 105°C for about 16 h to reach a constant weight, nitrogen analysed using the Kjeldhal method, and phosphorus and potassium analysed using spectrophotometry method.

Plankton monitoring and enumeration

Plankton populations were monitored in all experimental tubs. Zooplankton was enumerated weekly by passing 500 ml of water through a nylon plankton collecting net (100 mm). The organisms were concentrated in a 100ml centrifuge tube from which sub-samples of 1.0 ml were used for counting on Sedgewick- rafter counting chamber mounted on microscope at 40 x magnification (Brummett, 2000). Each culture was repeated three times during the experiment periods and average values were recorded. Enumeration was taken up at the short and once in 5 days four times in a period of 20 days.

Statistical analysis of data was performed by One -Way ANOVA with Duncan's test at the level of 95 % using SPSS 16. Statistical significance was set at the level of $P < 0.05$ with ± standard deviation (SD).

Results and Discussion

All animal excreta were analyzed at the beginning of the experiment and it was observed from Table.1 that groundnut oilcake had the highest the nitrogen (4.97%), phosphorus (0.15%) and potassium (0.73%). Cow urine had the highest amount of nitrogen (1.93%) potassium (1%). Chicken droppings and the highest amount of phosphorus (0.80%).(Fig.1)

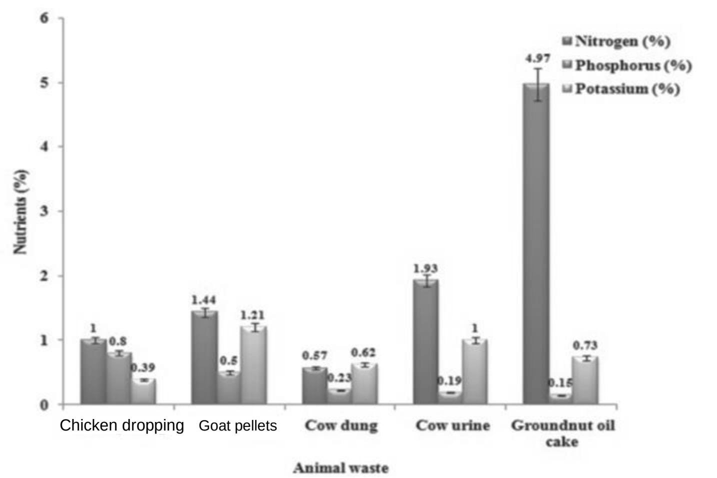

Fig. 1. Nitrogen, phosphorus and potassium levels of animal excreta

Table 1 show the total production of Ceriodaphnia (No ml^{-1}) in all groups at the end of the experiment in 20 days. The data clearly indicated that the production of *C.cornuta* in Chicken droppings (3 ± 0.58), (8 ± 1) ,(11 ± 0.57), (15 ± 1)and(18 ± 1) was significantly higher than those of other groups ($P < 0.05$) and the lowest production rate was observed in control (3 ± 0.57),(4 ± 0.58) ,(5 ± 0.58), (6 ± 1.52),and (8 ± 1).

From these results it was evident that *Ceriodaphnia* production in chicken droppings the highest compared to goat pellets, cow dung, cow urine and control.

The present investigation proved that the highest mean population of *Ceriodaphnia cornuta* in Chicken droppings and lowest in cow urine. Damle et al., (2010) reported the highest mean population

Table 1. Production of *Ceriodaphnia cornuta* (number/ml) from animal excreta

Medium	0 day	5th day	10th day	15th day	20th day
Control	3 ± 0.57a	4 ± 0.58 c	5 ± 0.58 c	6 ± 1.52 c	8 ± 1 c
Chicken droppings	3 ± 0.58 a	8 ± 1 a	11 ± 0.57 a	15 ± 1 a	18 ± 1 a
Goat pellets	3 ± 0.57 a	6 ± 1 a	9 ± 1 a	12 ± 1 a	16 ± 0.57 a
Cow dung	3 ± 0.57 a	5 ± 0.57 b	7 ± 1.15 b	10 ± 0.57ab	12 ± 1.15 b
Cow urine	3 ± 0.58 a	5 ± 0.58 c	6 ± 1 c	8 ± 1.54 b	10 ± 1bc

In a column, means followed by same alphabetic are not significantly different at $p< 0.05$. By DMRT

of Daphnia with 50g of poultry dung and lowest with 25 g of goat pellets.

Daphnia, growth was better in cattle manure ponds (Kamanga and Kaunda, 1998). Moina and rotifers were more abundant in chicken manured ponds. The number of zooplanktons was higher in the present experiment than reported by Brummett (2000) in an organic (napier grass) fertilization regime with *Tilapia rendalli* where numbers were as low as 1254 L^{-1} for rotifers,76 L^{-1} for copepods and 29 L^{-1} for cladocerans. However, Kamanga and Kunda (1998) reported higher numbers of copepods (71030 L^{-1}), rotifers (8530 L^{-1}) and cladocerans (17972 L^{-1}) in no-manured treatments in concrete tanks. These variations may be due to differences in the nutrient levels in the organic manures used.

Cladocerans, in general, feed on fine suspended particles,bacteria, algae, fungi and protozoans the particle size that can be cleared from water by the zooplankton was dependent upon the morphology of setae or movement of animal (Rigler, 1971). Both free living and aggregate bacteria are ingested by cladocerans and copepods (Wetzel, 2001). The maximum particle size that could be ingested by six species of Daphnia and smaller *Bosmina longirostris* depended upon the body size of the animals (Burns, 1969). For adult *Daphnia rosea* feeding on yeast, the critical concentration for feeding was between 0.75×10^5 and 1.0×10^5 cells per ml.

In conclusion, animal excreta are useful produces with less cost that can be recycled in low concentrations for the mass production of zooplankton especially Daphnia and serve as important sources of natural food for many commercially important species of fish and maintenance of aquarium fish.

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