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Efficacy of modified liquid panchagavya for production of zooplankton with reference to water quality

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Abstract
The present study deals with the efficacy of modified liquid panchagavya for production of zooplankton in reference to water quality. The experiment was carried out with five different doses of liquid organic manure, modified liquid panchagavya at the different levels *viz.* 0.15% (T_1), 0.20% (T_2), 0.25% (T_3), 030% (T_4), 0.35% (T_5), besides one control (T_0) using fresh cow dung at the rate of 50g/ tank. Each treatment group was with 3 replicates. The experiment was conducted in glass aquarium of 56 l capacity for 6 weeks. The zooplankton production and water quality were observed at weekly intervals. During experimental period, the water quality parameters were found to be congenial for zooplankton growth. Ranges of water quality parameters were: water temperature: 23.39-23.53℃, pH: 7.4-8.5, Electrical conductivity (EC): 1.26-1.47 mS/cm, DO: 6.11-6.92 mg/l, total alkalinity: 109-151.05 mg/l, total hardness: 770.68-962.83 mg/l, TDS: 806.40-942.93 mg/l, nitrate-nitrogen: 1.49-2.66 mg/l, orthophosphate: 0.36-0.68 mg/l. Significantly (p< 0.05) higher plankton population and zooplankton biomass were found in T_4 (748.43 No’s/l & 17.12 g/tank) followed by T3, T5, T2 and T1. The trend of dominant zooplankton categories observed by percent contribution in all treatments are Cladocerans (33%) followed by Copepods (30%), Nauplii (21%) and Rotifers (16%). From the study, it can be concluded that the use of 0.30% modified liquid panchagavya is most useful for zooplankton production to get good performance with aqua friendly effects on the rearing environment.

Keywords: Cow dung, panchagavya, zooplankton, water quality

1. Introduction

Fisheries and aquaculture remain important sources of food, nutrition, income and livelihoods for hundreds of millions of people around the world. It is probably the fastest growing food-producing sector and now accounts for 50 percent of the world's fish that is used for food [8]. Fisheries are one of the most important sources of revenue to economy of a country and as an important food sector in human nutrition [7]. Success of aquaculture depends on healthy cultured stock. A disease free healthy stock can be maintained by feeding live food to the cultured stock along with supplemented artificial feed [5]. Larvae of fish and shellfish are not very friendly to eat artificial supplemented feed. They require small size live foods for their nutritional demand. Live foods are easily digestible protein rich diet for fish and shellfish. The culture of live fish food largely depends on organic fertilization in the water. Till date various organic manure has been tried in aquaculture i.e. cowdung 13], Mustard oil cake [12], cattle [1], pig [6], Poultry [10] and duck manure [21], vermicompost [11]. Panchgavaya is traditionally used in various religious rituals including last rites for purification and house warming ceremonies and is also used as traditional medicine [4]. Panchagavya promotes growth (75%) and boost immunity (25%) and exactly fills the missing link to sustain the organic farming without any yield loss [23]. Biochemical properties of panchagavya revealed that it contains almost all the major nutrients like N, P, K and micronutrients and growth hormones like Indole acetic acid (IAA) and Gibberalic acid (GA) required for growth [18]. Panchagavya has uses, not only in the field of agriculture, but can also be used for the improvement of human and animal health [20]. Panchagavya increased the growth of phytoplankton and zooplankton, which improves fish feed availability and thus increased fish growth [14]. In view of this, present study aimed to evaluate the efficacy of modified liquid panchgavya for production of zooplanktons with reference to water quality.

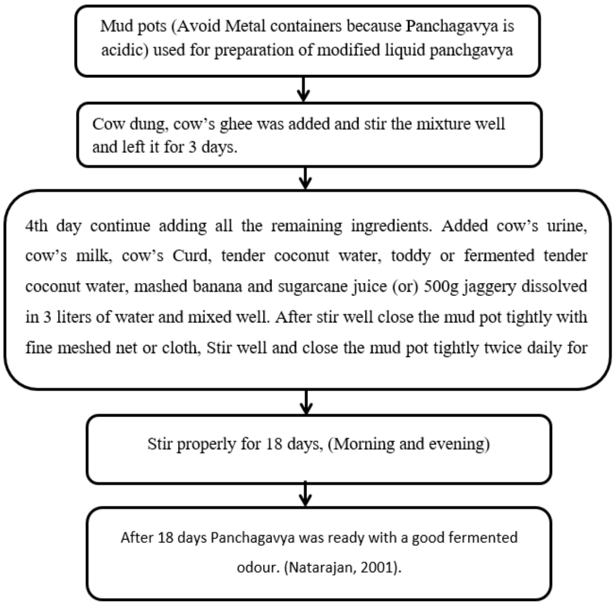
2. Materials and Methods

2.1 Experimental site

Experiment was conducted at the wet laboratory present at collage of fisheries MPUAT, Udaipur.

2.2 Preparation of "Modified Liquid Panchgavya"

The preparation of modified liquid panchagvya was carried out under Organic Farming Unit, DOR, MPUAT, Udaipur (Rajasthan). Modified liquid Panchagavya [14] prepared by using fresh cow dung (5kg), cow urine (3L), cow milk (2L), cow ghee (500gm), cow curd (2L), sugar cane juice (3L or 500gm jaggery in 3L water), tender coconut water (3L), ripe banana fruits (12nos.) and toddy (2L or 100gm yeast and 100gm jaggery in 2L warm water). Flow chart for the preparation of modified liquid panchgavya given bellow.



2.3 Experimental design

The duration of experiment was six weeks commenting from third week of April, 2018. In the agriculture field recommended Panchagavya concentrations for various crops ranging from 2% to 5% and hence for zooplankton culture similar concentrations and further low concentrations were used. Five doses of "Modified Liquid Panchagavya" were selected for the present study i.e. 0.15% (T_1), 0.20% (T_2), 0.25% (T_3), 0.30% (T_4), 0.35% (T_5), besides one control (T_0) using fresh cow dung @50g/tank (without "Modified Liquid Panchagavya"). The experiment was conducted in rectangular glass aquarium tank containing 50L ground water, kept in wet lab. There were three replications for each experimental group.

2.4 Zooplankton analysis

The samples were collected for zooplankton analysis, by filtering water through plankton net of bolting silk No. 30 and concentrated up to 50 ml. The samples were observed under the microscope and qualitative and quantitative analysis was done as per the standard keys procedures [3]. The zooplankton species have been identified with the help of standard key Protocol [15]. The quantitative estimation was done by using Sedge wick - Rafter Cell and expressed as numbers per liter.

2.5 Water quality

The evaluation of different water quality parameters and zooplankton analysis were carried out with the standard protocol of APHA [3].

3. Results and Discussion

3.1 Water quality analysis

The water temperature, pH, EC, DO, total alkalinity, total hardness, TDS, nitrate nitrogen and orthophosphate was found in the range 23.29-23.76 °C, 7.60-8.55, 1.26-1.47 mS/cm, 6.11- 6.56 mg/l, 109.48-151.05 mg/l, 770.68-962 mg/l, 806.40-942.93MG/L, 1.49-2.66 mg/l and 0.36-0.68 mg/l, respectively. The electrical conductivity (EC), dissolved oxygen, pH nitrate nitrogen and orthophosphate were found significantly ($p < 0.05$) favorable for zooplankton production. Water temperature was found to be quite close to the recorded by Goliya [9] such variation in temperature under Indian condition appears fairly suitable to support good zooplankton development with the use of modified panchagavya treated. Two researcher [10, 22] suggested a favorable pH of 8.0 for growth and multiplication of live fish food organisms. In the present study, slightly alkaline pH values have been recorded in the range of 7.6 to 8.5, which is very close as suggested by Shirgur [19]. In present study the nitrate nitrogen showed a definite pattern in all the treatments, being high initially and just at the fertilization between the experiments in the treated waters as compared to the control. Subsequently, the NO3–N was reduced in the treated waters. This may be explained by notably higher biological productivity (i.e. zooplankton) which extracted NO_3-N from the water media. The phosphate content showed significance positive relationship with the abundance of plankton culture [22]. The enrichment (phosphates and nitrates) in culture waters through modified panchagavya application leads to an increase in zooplankton biomass production. In the present study, the modified panchagavya has provided necessary nutrients for ample primary production. In fact, in the aquatic medium planktonic organisms multiplication and growth are directly influenced by available as inorganic nitrogen and orthophosphate in the water. Anonymous [2] observed that the panchagavya has been preferred for production of rotifers among other organic medium. The peak of plankton production was noticed with 1370 individual/250ml on 12th day at panchagavya. Further the author separated that higher application rate of fertilization reduced the water quality and caused adverse impact on rotifers population. Initially nitrate-nitrogen (NO3-N) and the orthophosphates (PO4) are utilized for the phytoplankton development. The utilization of organic fertilizer has a positive effect on zooplankton abundance. The zooplankton production in fertilized aquaria with liquid organic manure i.e. modified panchagavya is confirmed by higher zooplankton production rates in treated waters than control.

3.2 quantitative and qualitative analyses of plankton and relative dominance

The minimum zooplankton population was observed in T_0 (control) i.e. 93.2 No's/l in 5th week, whereas the maximum zooplankton population was observed in T_4 i.e. 995.35 No's/l during the 3rd week (Fig. 1). However, the maximum zooplankton was observed in T_4 i.e. 748.43 No's/l, whereas the lowest production was in T_0 (100.37) No's/l (Table 1 and Fig. 1). The trend of zooplankton population from maximum to minimum with their weekly average value were T_4 (748.43) > T_3 (597.33) >T_5 (540.45) > T_2 (450.56) > T_1 (256.00) > T_0

(100.37). During 2nd, 3rd and 4th week there was significant difference (P< 0.05) found between control and T_2, T_3, T4 & T_5 except control and T_1.

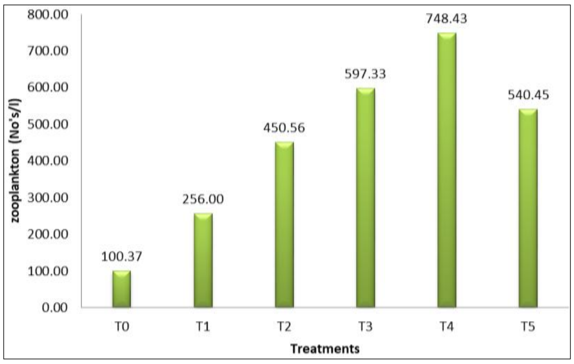


Fig 1: Weekly total Zooplankton population (No's/liter) produced with modified liquid panchagavya in different treatments

The qualitative analysis of zooplankton was carried out for the four categories of zooplankton *viz.* rotifers, cladocerans, copepods and their nauplii. The average values of four categories of zooplankton and their percent distribution are summarized and shown in Table 1. The results show that the minimum and maximum numbers (No's/l) of the four zooplankton groups were rotifers 27.34 & 113.82, in T_0 and T_4 cladocerans 20.34 & 299.50, in T0 and T3 copepods 29.30 & 233.73 nauplii 22.21 & 143.06 in T_0 and T_4 respectively. The results also indicate that over all there was maximum number of cladocerans (33%) followed by Copepods (30%), Nauplii (21%) and Rotifers (16%). Similarly, Palsaniya [16] recorded cladocerans as a dominating plankton group followed by nauplii and copepods in zooplankton culture using vermicompost and farm yard manure. However, Rahman and Hussain [17] found cyclops (68.25% and 60.28% of total copepods) as the most dominant zooplankton among the four categories in under natural conditions culture ponds.

Table 1: Distribution of zooplankton categories: total of average value (no's/l) and their percent contribution in average harvest**.**

Treatment	Zooplankton categories and their percent distribution								Total of average (No's/l)
	Rotifers	%	Cladocerans	%	Copepods	%	Nauplii	%	100.37
T0	27.34	27.56	20.34	20.51	29.30	29.54	22.21	22.39	256.00
T1	41.75	16.31	55.11	21.53	87.98	34.38	71.10	27.78	450.56
T2	50.63	11.24	167.81	37.26	145.72	32.36	86.17	19.13	597.33
T3	61.32	10.27	299.50	50.15	157.29	26.34	79.07	13.24	748.43
T4	113.82	15.21	257.70	34.44	233.73	31.23	143.06	19.12	540.45
T5	76.41	14.14	186.65	34.54	155.53	28.79	121.74	22.53	100.37

3.3 Zooplankton Biomass
The minimum zooplankton biomass was observed in T_0 (control) i.e. 1.93 g (week 3rd), whereas, the maximum zooplankton biomass was observed in T_4 i.e. 22.76 (week 3rd). The trend of zooplankton biomass from maximum to minimum with their average weekly biomass in g/50 l can be written as T_4 (17.12g) > T_3 (13.66g) > T_5 (13.09g) > T_2 (10.31g) > T_1 (5.85g) > T_0 (2.30g). There was significant (P< 0.05) difference between control and other treatments during 1st and 5th week. During 2nd, 3rd and 4th week there was significance difference (P< 0.05) was found between control and T_2, T_3, T4 & T_5 except control and T_1.

4. Conclusion
From the present study, it can be concluded that modified "Modified Liquid Panchagavya" can be used for production of zooplankton @ 0.30% as it is found useful for higher zooplankton production. The water qualities also remain congenial with the liquid organic manure i.e. "Modified Liquid Panchagavya". Fertilization through "Modified Liquid Panchgavya" in the rearing of aquaculture species can be beneficial. Further research required in the rearing environment at the farm level.

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