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Comparative study on growth performance of amur common carp and Indian major carps in ponds integrated with and without poultry farm

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Abstract
The present study was conducted to evaluate the growth performance of Amur common carp under polyculture with Indian major carps (Catla and Rohu) in selected ponds of FRIC, Bhutnal, Vijayapur, Karnataka integrated with and without poultry farm. For this study two ponds were selected. Fingerlings of uniform size were selected and stocked at the rate of 1 No/m^2 and the fishes were fed with floating carps feed @ 3% of fish body weight. Among different species stocked, Amur common carp had shown the highest growth (1328.7g and 29.8cm respectively) compared to Catla (1148.9g and 27.9cm respectively) and Rohu (819g and 27.1cm respectively) in pond integrated with poultry farm. Similarly in pond without integrated with poultry farm, Catla had shown the maximum growth (1250. 8g and 29.1cm respectively) Amur common carp followed (1191.69g and 27.4cm respectively) and Rohu (860g and 26.09cm respectively). The specific growth rate of Catla was also highest both the ponds integrated with (2.30) and without (2.27) poultry farm followed by Amur common carp and Rohu. Amur common carp exhibited a better growth compared to other species (Catla and Rohu) in ponds integrated with poultry farm might be due to the omnivorous feeding habit, burrowing nature, spilling off poultry feed and the protein rich droppings from the poultry harbor the desired planktons in the ponds and also consumed directly as a feed. It could be inferred from this study that Amur common carp is most suitable species for polyculture with Catla and Rohu and recommend integrated fish farming in ponds to increase the production and productivity of fish.

Keywords: Integrated fish farming, amur common carp, poultry farm, floating carps feed

Introduction

Fisheries and aquaculture provide livelihoods for more than 500 million people [1]. Because of population growth, economic development and changes in food habits, demand for fish and fishery products is remain increasing [2]. Fish production from capture fisheries is remaining constant, even declining and aquaculture is the alternative way to meet the growing demand of fish in the country [3]. In India, the total fish production is reached to 12.60 MMT during 2017-18, of which inland sector contributed 65% and culture fisheries contributed 50%. Presently, India ranks second in the world in total fish production with contribute of 6.3%.

Feed supply is the major constraints of fish farming in India. Integration of fish farming with poultry helps for maximize resources utilization and manage the problem of feed supply under low cost aquaculture system [3]. Fish production in the ponds can be increased by integrated fish cum poultry farming [4, 5]. Efficiency of both livestock farming and fish culture increases in integrated farming system as direct use of the waste from livestock production increase the pond productivity [6]. Integrated fish cum poultry farming is an excellent approach for sustainable fish production, income generation and employment opportunity of the poor rural households [7].

Amur common carp (*Cyprinus carpio*) is an improved strain of wild common carp of Hungarian origin [8]. It has greater practical significance in low-input aquaculture systems due to its better growth performance, late maturing, hardy, accepts artificial feed and has similar food habit to that of existing stock [9]. Therefore, the comparative study on growth performance of Amur common carp and Indian major carps in ponds of FRIC, Bhutnal, Vijayapur integrated with and without poultry farm under the project funded by SCSP/ TSP grants, Government of Karnataka.

Materials and Methods
The present study was conducted to evaluate the growth performance of Amur common carp under polyculture with Indian major carps in ponds integrated with poultry farming and without during January 2019 to October 2019.

Experimental ponds
Two ponds of area 80ft x 50ft and 80ft x 40ft located at FRIC, Bhutnal, Vijayapur, Karnataka were used. The healthy Amur common seeds and IMCs were procured from FRIC (I), Hesaraghatta, Bengaluru. After pre stocking management, both the ponds are stocked with fish fingerlings comprising of 40% Catla, 20% Rohu and 40% Amur common carp. The details of stocking are presented in Table 1.

Treatments
1. Treatment 1, pond Integrated with poultry farm (T1),
2. Treatment 2, pond without integrated with poultry farm (T2).

In treatment 1, one side of the pond, poultry sheds were constructed using Iron MS angle and bamboo polls. Totally 40 chicks were stocked comprising of 20 Giriraja and 20 Girirani birds. Poultry droppings were collected every day and spread all over the pond. Where as in treatment 2, the pond was fertilized by applying cow dung.
Floating carps feed (28% protein, 4% fat) was used. The feed was provided @ 3% of fish body weight. After a culture period of Ten months, the fishes were captured using drag net and growth parameters were assessed. The fish growth (length and weight) data were collected from pond and the growth gain was studied following standard methods.

1. The average body weight gain (ABGW) in grams was determined using following equation:

WG = W1-W0

Where**:** *WG* = Average weight gain (g), *W1* = Average final weight (g) and *W*= Average initial weight (g)

2. The body length increment (cm) was determined using following equation:

L=L1-L0

Where: *L* = Length increment (cm), *L*1 = Average final length (cm) and *L*0 = Average initial length (cm)

3. Specific Growth Rate (SGR) was determined using following equation:

SGR = (Ln Wt - Ln W0)/t x 100

Where: *Wt* = Final weight (g), *W0* = Initial weight (g) and *t* = duration of experimental days.

Water quality monitoring
To assess the water quality of pond water in relation to aquaculture, surface water samples were collected and analysed at an interval of one month. The samples from two ponds were collected using a plastic bucket. The water sample was stored in one litter plastic bottles with air tight cap for analysis of certain parameters (hardness, Ammonia nitrogen, orthophosphate etc.) in the laboratory. Whereas, water temperature, pH, dissolved oxygen (DO), alkalinity, were analysed at the sampling sites. All the parameters were analyzed as per the standard methods [10].

Statistical analysis
The data collected during this study were processed for selected statistical parameters (i.e. mean, range and standard error) for drawing specific conclusion.

Results and Discussion
The results pertaining to range and mean values of physico-chemical parameters, are given in Table 2. All the water quality parameters were found to be within the acceptable ranges during the culture period. During the study, water pH varied between 7.1-7.8 in both the ponds and it is suitable for growth and survival of fish [11]. The dissolved oxygen (DO) was in acceptable range and favorable for the growth of fish in both the ponds and its content varied from 4.5 – 6.2 mg/l, which range [12]. Alkalinity was in the range of 215-260 mg/l which is in the acceptable range for fish culture. Hardness (125-165 mg/l) was within the range and suitable for fish growth and survival [13]. The ammonia concentration in the selected water ponds ranged from 0.15-0.40 mg/l. Low level of ammonia in selected water bodies attributed to additional uptake of ammonia by periphyton. However, inorganic nutrient, phosphorus concentration (0.3 – 0.95 mg/l) was within the acceptable ranges for polyculture [14].
The data pertaining to growth of Amur common carp and Indian major carps *viz. Catla catla* and *Labeo rohita* are presented in Table 3 and Fig 1. Amur common carp had shown the highest growth (1328.7g and 29.8 cm respectively) followed by Catla (1148.9 g and 27.9cm respectively) and Rohu (819 g and 27.1cm respectively) in Treatment 1. Whereas in Treatment 2 also, Catla had shown the highest growth (1250.80 g and 29.1 cm respectively) followed by Amur common carp (1191.69 g and 27.4 cm respectively) and Rohu (860 g and 26.09 cm respectively). This finding is in conformity to the findings reported by Rajanna *et al.* (2019)n [15], who found that the mean weight gain of Amur common carp were higher in seasonal water bodies of Chamrajnagar district, Karnataka under polyculture system compared to other carps. Similarly, Hari *et al*. (2018) [16] noticed faster growth rate Amur common carp compared to other carps in polyculture system. This finding is in accordance with the results reported by Basavaraju and Reddy (2013) [9] where they showed that growth of Amur common carp was faster over the existing of common carp.
The higher weight gain of Amur common carp in Treatment 1 might be due to the dominancy of in feed consumption, less inter-species competition for preferred natural food, burrowing behavior and it leads to release of nutrients from pond bottom, release of obnoxious gasses from the bottom and increase the productivity consequently results the better yield [16]. The phenomenon of nutrient release in the pond bottom due to stirring effects of common carp was well documented [17, 18, 19].
The comparative higher growth of Catla in Treatment 2 was observed in selected ponds and it might be due to stirring up mud bottom by Amur common carp while feeding improves the nutrient recirculation. This, in turn, helps in development of phytoplankton in the water column, on which Catla feeds [20, 21, 19]. Similarly, the higher growth of Catla compared to Rohu on both the ponds might be due to phytoplankton

composition. From the phytoplankton, Catla positively selects diatoms [20, 21] which could be more abundant in ponds.
The specific growth rate of Catla was highest in both Treatment 1 (2.31%) and Treatment 2 (2.31%) followed by Amur common carp and Rohu (Table 3). The SGR was higher in Catla compared to Amur common carp and Rohu could be due to, Catla is feed mainly on zooplankton and efficient utilizer of artificial feed and natural food resources [22]. Similarly Hari *et al*. (2018) [16] observed higher SGR in Amur common carp under polyculture with Indian major and opined that, It could be due to the burrowing nature of Amur common carp, resulting better primary productivity.
The amur common carp growth was higher in Treatment 1 compared to Catla and Rohu (Table 3 and Fig. 1) and it might be due to spilling protein rich droppings from the poultry house helped for increase of pond productivity inturn helps for higher amur common growth [3]. Poultry manure is rich in nutrients, especially the fresh drops improve the desired planktons in the ponds, it is consumed directly as a feed and it could be the reason for faster growth rate of amur under poultry integration [4, 5]. The growth of Catla was higher in Treatment 2 compared to Amur and Rohu and it might be due to catla benefited by directly consuming the feed and indirectly from the fertilized pond by using cow dung harboring sufficient planktons.

Table 1: Stocking of Amur common carp and IMC seeds in ponds

S. No	Particulars	Name of Village tank	
		Treatment 1	**Treatment 2**
1	**Area (m^2)**	371	297
2	Stocking density	370	300
3	**Size of fingerlings (cm)**		
A	Amur common carp	4.5±0.05	4.4±0.05
B	Catla	4.3±0.03	4.4±0.03
C	Rohu	4.1±0.09	4.0±0.09
4	**Weight of fingerlings (g)**		
A	Amur common carp	1.3±0.09	1.31±0.09
B	Catla	1.1±0.05	1.2±0.05
C	Rohu	1.0±0.33	1.0±0.33
5	Stocking ratio (Amur common carp: Catla: Rohu)	40 :40:20	40 :40:20

Table 2: Range and mean (in parenthesis) values of water quality parameters in ponds integrated with and without poultry farm

Sl. No	Parameters	Treatment 1	Treatment 2
1	pH	7.1-7.7 (7.40)	7.3-7.8 (7.55)
2	Total Hardness as $CaCo_3$ (mg/L)	125-155 (140)	130-165 (147.5)
3	Total alkalinity (mg/L)	215-250 (232.5)	225-260 (242.5)
4	Phosphate (ppm)	0.7-0.95 (0.82)	0.3-0.6 (0.45)
5	Ammonia (ppm)	0.15 – 0.30 (0.22)	0.25-0.40 (0.325)
6	Dissolved oxygen (mg/L)	4.5-5.8 (5.15)	5.4 – 6.2 (5.80)

Table 3: Growth summary of carps (Amur common carp and Catla) in ponds integrated with and without poultry farm (value ± standard error)

Water Body	Species	Weight(g)			Length (cm)			SGR (%)
		Initial	Final	NWG	Initial	Final	NLG	
Treatment 1	Amur carp	1.3±0.09	1330±7.30	1328.7	4.5±0.05	34.3±0.09	29.8	2.30
	Catla	1.1±0.05	1150±8.90	1148.9	4.3±0.03	32.2±0.17	27.9	2.31
	Rohu	1.0±0.33	820±6.80	819	4.1±0.09	31.2±0.23	27.1	2.23
Treatment 2	Amur carp	1.31±0.09	1193±5.80	1191.69	4.4±0.05	33.9.5±0.18	29.1	2.27
	Catla	1.2±0.05	1252±3.87	1250.8	4.4±0.03	31.8±0.27	27.4	2.31
	Rohu	1.0±0.33	861±7.29	860.0	4.0±0.09	30.09±0.81	26.09	2.25

NWG – Net weight gain, NLG - Net length gain, SGR – Specific growth rate

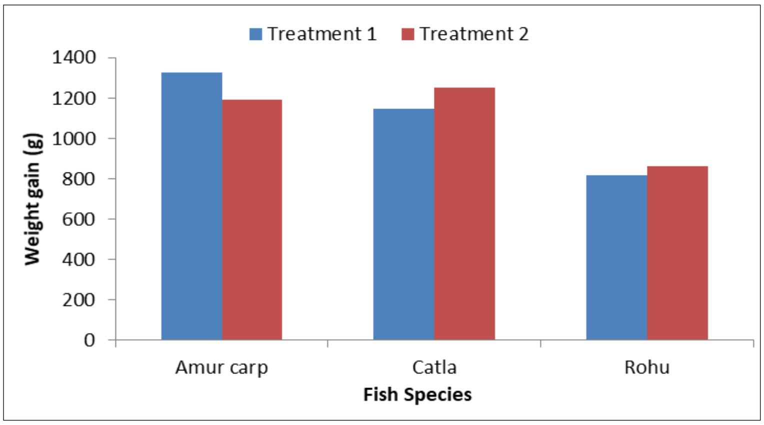

Fig 1: Growth performance of carps (Amur common carp, Catla and Rohu) value in ponds integrated with and without poultry farm ± standard error)

Conclusion
The growth rate of Amur common carp, Catla and Rohu was faster in the pond integrated with poultry farming. Polyculture of Amur common carp with IMC under poultry integration can increase the production and productivity of fish in small scale farms at house hold level in suitable agro-ecologies. Following the stocking ration of Amur common carp, Catla and Rohu @ of 40: 40: 20 are more profitable and economically feasible in carp polyculture system in ponds.

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