Journal of Entomology and Zoology Studies

Available online at www.entomoljournal.com

E-ISSN: 2320-7078
P-ISSN: 2349-6800
JEZS 2019; 7(6): 539-542

Received: 06-09-2019
Accepted: 10-10-2019

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Growth performance of amur common carp under polyculture with Indian major carps in village tanks of Vijayapur district, Karnataka

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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). For this study two village tanks *viz.*, Mulwad and Karjol of Vijayapur district 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 @ 1% of fish body weight. Among different species stocked, Amur common carp had shown the highest growth in terms of gain in weight and length (1579.9g and 32.1cm respectively) followed Catla (1050g and 30.0cm respectively) and Rohu (729.3g and 30.1cm respectively) in Mulwad village tank. Similarly in Karjol Village tank, Amur common carp had shown the maximum growth in terms of gain in weight and length (1388.8g and 31.2cm respectively) followed Catla (978.8g and 27.8cm respectively) and Rohu (649g and 30.1cm respectively). The specific growth rate of Amur common carp was also highest both in Mulwad (2.42%) and (2.35%) Karjol Village tank followed by Catla and Rohu. Amur common carp exhibited a better growth compared to other species (Catla and Rohu) in village tanks, which may be due to the omnivorous feeding habit and resistance to fluctuation in water quality. It could be inferred from this study that Amur common carp is most suitable species for polyculture with Catla and Rohu in water bodies like village tanks.

Keywords: Polyculture, amur common carp, village tank, floating carps feed

Introduction
In India, fish production has been increasing steadily during last decade and it reached to 12.66 MMT in 2017-18. Bulk of the fish production in India is contributed by the three Indian major carps (IMCs), namely Catla (*Catla catla*), Rohu (*Labeo rohita*) and Mrigal (*Cirrhinus mrigala*) to the extent of 70 to 75% of the total freshwater fish production and these are most preferred fishes for aquaculture because of their fast growth and higher acceptability to consumers [1], followed by exotic carps includes silver carp, grass carp and common carp contributing 25 to 30% forming the second important group [2]. Amur common carp (*Cyprinus carpio*) is an improved strain of wild common carp of Hungarian origin [3]. 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 [4].

In village tank of Vijayapur district, Polyculture of carps is practiced with low to moderate inputs, particularly organic fertilizers and feed. Sustainable growth of aquaculture in village tank is entailed to meet the rising demand for fish. Fish Farmers Development Authority of the Government of India collaboration with World Bank provide the fund for initiating aquaculture in inland water bodies. Technical, financial and extension support is provided to fish farmers for taking up aquaculture in village ponds and tanks [5].

The Vijayapur district houses a plenty of small water bodies which includes 159 tanks of more than 40 hectares, 81 Grama Panchayath tanks and have great potential for inland aquaculture. Various Development Programmes have been taken up for the fisheries campaign. In many Village tanks of the district, a minimum of 2m water is maintained throughout the year and there is a need for utilize these water bodies by growing fish through available technology. Therefore, the present investigation was conducted to study the Growth performance of Amur common carp under polyculture with Indian major carps in village tanks of Vijayapur district, Karnataka under SUJALA III project.

Materials and Methods

The present study was conducted to evaluate the growth performance of Amur common carp under polyculture with Indian major carps in Village tanks of Mulwad and Karjol of Vijayapur district, Karnataka during August 2018 to May 2019. The geographical location and area of the selected village tanks are presented in Table 1.

All the two selected village tanks were stocked with Amur common carp and Indian major carps fingerlings. The health of Amur common seeds and IMCs were procured from FRIC (I), Hesaraghatta, Bengaluru and stocked. The details of stocking are presented in Table 2.

Floating carps feed (28% protein, 4% fat) was used. The feed was provided @ 1% 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 individual Village tank. 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:

$$SGR = (Ln\ Wt - Ln\ W0)/t \times 100$$

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

Table 1 The geographical location and area of the selected village tanks

S. No.	Name of the villege tank	Area (acre)	North latitude	East longitude
1	Mulwad	2	16° 35' 09.36"	75° 45' 00.55"
2	Karjol	2	16° 35' 17.36"	75° 42' 16.76"

Table 2 Stocking of Amur common carp and IMC seeds in Village tanks of Mulwad and Karjol

S. No	Particulars	Name of Village tank	
		Mulwad	Karjol
1	Area (m^2)	8000	8000
2	Stocking density	8000	8000
3	Size of fingerlings (cm)		
A	Amur common carp	4.1±0.05	4.3±0.05
B	Catla	4.2±0.03	4.4±0.03
C	Rohu	3.6±0.09	4.1±0.09
4	Weight of fingerlings (g)		
A	Amur common carp	1.1±0.09	1.2±0.09
B	Catla	0.9±0.05	1.2±0.05
C	Rohu	0.7±0.33	1.0±0.33
5	Stocking ratio (Amur common carp : Catla: Rohu)	4:3.5:2.5	4:3.5:2.5

Water quality monitoring

To assess the water quality of village tanks in relation to aquaculture, surface water samples were collected and analysed at an interval of one month. The samples from two village tanks 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 analysed as per the standard methods [6].

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 3. All the water quality parameters were found to be within the acceptable ranges during the culture period. During the study, water pH varied between 7.0-8.5 in selected village tanks and it is suitable for fish growth and survival [7]. The dissolved oxygen (DO) content in both the village tanks varied from 7.1– 7.7 mg/l, which was in the acceptable range and favorable for the growth of fish [8]. Alkalinity recorded in the present study was in the range of 200 – 250 mg/l which is in the acceptable range for fish culture. Hardness was in the range of 120-150 mg/l in selected tanks which was within the range of suitable for fish growth and survival [9]. The ammonia concentration in the selected water bodies ranged from 0.01-0.2 mg/l. Low level of ammonia in selected water bodies attributed to additional uptake of ammonia by periphyton. However, inorganic nutrient, phosphorus concentration varied from 0.2 – 0.5 mg/l and was within the acceptable ranges for polyculture [10].

The data pertaining to growth of Amur common carp and Indian major carps *viz. Catla catla* and *Labeo rohita* are presented in Table 4 and Fig 1. Among different species stocked, Amur common carp had shown the highest growth in terms of gain in weight and length (1579.9g and 32.1cm respectively) followed by Catla (1050g and 30.0cm respectively) and Rohu (729.3g and 30.1cm respectively) in Mulwad villege tank. Similarly in Karjol Village tank also, Amur common carp had shown the highest growth in terms of gain in weight and length (1388.8g and 31.2cm respectively) followed by Catla (978.8g and 27.8cm respectively) and Rohu (649g and 30.1cm respectively). This finding is in conformity to the findings reported by Rajanna *et al.* (2019) [11], 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, Amur common carp exhibited faster growth rate compared to other carps in polyculture system [12].

The higher mean weight gain of Amur common carp might be due to the less inter-species competition for preferred natural food, dominancy of in feed consumption, burrowing behavior which results in the release of nutrients from pond bottom, increase the productivity and it also releases obnoxious gasses from the bottom consequently results the better yield [12]. The phenomenon of nutrient release due to stirring effects of common carp in the pond bottom was well documented [13, 14, 15]. This finding is in accordance with the results reported by

[4] where they showed that growth of Amur common carp was faster over the existing of common carp.

The comparative higher growth of Catla is observed in selected village tanks, it could be due to Amur common carp stirring up mud bottom while feeding improves the nutrient recirculation. This, in turn, helps in phytoplankton development in the water column, on which Catla feeds [16, 17, 15]. Similarly the higher growth of Catla compared to Rohu on village tanks of Vijayapur district might be due to phytoplankton composition. From the phytoplankton, Catla positively selects diatoms [16, 17], which could be more abundant in village ponds.

The specific growth rate of Amur common carp was also highest both in Mulwad (2.42%) and (2.35%) Karjol Village tank followed by Catla and Rohu (Table 4). Similar results are of Higher SGR were obtained in Amur common carp under polyculture with Indian major [12] and opined that, It might be due to the burrowing nature of Amur common carp, resulting better primary productivity.

The SGR was higher in Catla compared to Rohu might be due to, Catla is an efficient utilizer of artificial feed and natural food resources and it feed mainly on zooplankton [18]. The present work demonstrated that Amur common carp could be incorporated as an alternative species against existing common carp and Mrigal and it can be culture with Catla and Rohu by following the Stocking ratio 40: 35: 25 would improve fish production.

Table 3: Range and mean (in parenthesis) values of water quality parameters in selected village tanks of Vijayapur district

Sl. No	Parameters	Mulwad village tank	Karjol Village tank
1	pH	8.0-8.5 (8.25)	(7-8.5) (7.75)
2	Dissolved oxygen (mg/L)	7.5-7.7 (7.6)	7.1-7.5 (7.3)
3	Total Hardness as $CaCo_3$ (mg/L)	130-150 (140)	120-150 (135)
4	Total alkalinity (mg/L)	200-250 (225)	225-250 237.5)
5	Ammonia (mg/l)	0.01-0.1 (0.055)	0.1-0.2 (0.15)
6	Phosphate (mg/l)	0.2-0.3 (0.25)	0.1-0.5 (0.3)

Table 4: Growth summary of carps (Amur common carp, Catla and Rohu) in selected village tanks of Vijayapur district (value ± standard error)

Water Body	Species	Weight(g)			Length (cm)			SGR (%)
		Initial	Final	NWG	Initial	Final	NLG	
Mulwad Village tank	Amur common carp	1.1±0.09	1580±7.30	1579.9	4.1±0.05	36.3±0.09	32.2	2.42
	Catla	0.9±0.05	1050±8.90	1049.10	4.2±0.03	34.2±0.17	30.0	2.35
	Rohu	0.7±0.33	730±6.80	729.30	3.6±0.09	33.7±0.23	30.1	2.31
Karjol Village Tank	Amur common carp	1.2±0.09	1390±5.80	1388.80	4.3±0.05	35.5±0.18	31.2	2.35
	Catla	1.2±0.05	980±3.87	978.88	4.4±0.03	32.2±0.27	27.8	2.23
	Rohu	1.0±0.33	650±7.29	649.00	4.1±0.09	30.6±0.81	26.5	2.15

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

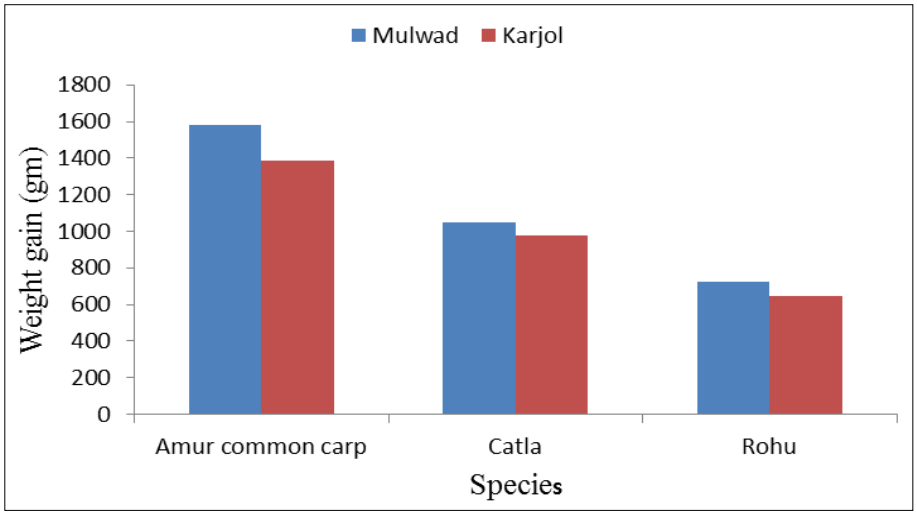

Fig 1: Growth performance of carps (Amur common carp, Catla and Rohu) in selected Village tanks of Vijayapur District (value ± standard error)

Conclusion

This study indicated that the overall performance in terms of growth (Length and Weight) and SGR of Amur carp is better than Catla and Rohu. Following the stocking ration of Amur common carp, Catla and Rohu @ of 40: 35: 25 are more profitable and economically feasible in carp polyculture system in village tanks.

Acknowledgments

The authors gratefully acknowledge the World Bank for funding KWDP-Sujala-III Project. The authors thank the Nodal Officer, KWDP-Sujala-III Project; KVAFSU, Bidar for providing guidance and necessary facilities in conducting this research work and Senior Farm Superintendent and Head, FRIC (I), Hesaraghatta, Banglore for providing the Amur Common Carp fish seed to the project.

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