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RESEARCH ARTICLE

GROWTH PERFORMANCE OF INDIAN MAJOR CARPS IN ABANDONED AND UNPRODUCTIVE CHINA CLAY MINES OF INDIA: A NEW APPROACH

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ABSTRACT

The present studies focused on the growth performance of Indian major carps in abandoned china clay mines of Birbhum district, West Bengal. The results obtained during the experimental trial from eleven months in terms of changes in soil, water and biological characteristics of the 'Khadan' or china clay pits, growth of cultured fish species (*Catla catla, Labeo rohita* and *Cirrhinus mrigala*) and production potential. The growth rate of *Catla catla* is comparatively higher than *Labeo rohita* and *Cirrhinus mrigala*. Highest growth was observed in *Catla catla* (810.36 ± 13.52g) followed by *Labeo rohita* (620.35 ± 12.51g) and *Cirrhinus mrigala* (584.3 ± 4.99 g) as compared to growth of experimental fishes in control pond *Catla catla* (914.4g), *Labeo rohita* (723.9±7.9g) and *Cirrhinus mrigala* (673.7±5.8g). After successful introduction of Indian major carps in the pits of china clay mines or 'Khadans', the production potential up to a level of 3,321.8 kg ha^{-1} $year^{-1}$ as compare to the production of control pond 5, 1274 kg ha^{-1} $year^{-1}$.

Key words: China clay, 'Khadan', Indian Major Carps , Growth and Production.

INTRODUCTION

The progress in the fishery science made in the last few decades has been tremendous. Research in fisheries science of last 50 years has improved the technique of fish culture but the techniques are waiting for wider use in production units. Our motto is to develop such a technology, which can easily knock at the door of the rural farmers, and they can also understand easily the utility of such technology. The fresh water ponds and tanks of West Bengal stand as an asset in India. There are about 1,089,876 ponds and tanks in West Bengal with an approximate area of more than 28466.55 hectares (State Planning Board, 1974). Of these, 53 percent are perennial and the rest contain water for seven to eight months in a year. Besides this, the reservoir area of West Bengal is more than 235678.80 hectares. Potentiality of inland fishery resources in West Bengal is one of the richest in India. During 1964-74 inland fish catch in West Bengal grew at a rate of 8.80 percent annually (compound). Since 1978, the fish production in the state of West Bengal, India has been increasing only at the rate of 3.31 percent per annum. Though potentially rich, the per hectares yield in West Bengal is still very low as well as in India. It is quite clear from the above fact that there is a great scope to increase the fish production by proper utilization of the inland water resources (Jhingran, 1975). But the rate of production has been found to be less than 600 Kg ha^{-1} $year^{-1}$ (Chakraborty, 1972), because of various conditions of factors and "carrying capacity" of the pond. Moreover, the methods so far followed in different area were not based on the scientific techniques. The "carrying capacity" of a pond is not a constant factor; it can be improved by the application of fertilizers (Yashouv, 1961) and modern technology. Production of a fish pond mainly depends on its soil condition and the soil condition is reflected in the water component of a pond. Soil is the storehouse of nutrients in an aquatic ecosystem. Mineralization and absorption of excess materials are taken up by the soil.

After 1950's the lifting of china clay started at Patel Nagar area of Birbhum district and later on spread in the districts of south West Bengal, particularly in Bankura and Paschim Medinipur district. The china clay mostly contains aluminium oxide (Al_2O_3 - 35%), Silicon dioxide (SiO_2 - 35%), water (H_2O - 22%) and salt of CaO, NaO, KO and TiO_2. If we are able to culture Indian major carps and to utilize all the mine sectors available in the district of Birbhum, Bankura and Paschim Medinipur of West Bengal, if will provide additional aquaculture area of about 1000 hectare in near future. More than 5000 people will be employed in the culture operation per annum, if all the abandoned mine water area were utilized for aquaculture. If aquaculture practices could be done

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scientifically in 'Khadan' area, the approximate production will be 3619.5 kg ha^{-1} yr^{-1} to 10,000 kg ha^{-1} yr^{-1}.

MATERIAL AND METHODS

The experiment was carried out in a pits or 'Khadan' of china clay mines of Dubrajpur block, Birbhum district of West Bengal, India (Latitude 23° 41′ N, Longitude 87° 41′ E). A 0.21 hectare water area was considered for experimental purpose, which has 4.9-meter depth. The 'Khadan' was free from aquatic weeds, water is highly alkaline and contains heavy colloidal particles. A highly productive pond was considered as control to compare the growth and production of our experimental results, situated at Midnapore sadar (nearer to University Campus) of Paschim Medinipur district (Latitude and Longitude of this area 22° 25′ N and 87° 20′ E), West Bengal, India. Area of the control pond was about 0.22-hectare and depth is about 3.7 meters. Control pond was well exposed and had some floating aquatic weeds. Test fishes for the present experiment includes three Indian major carps, viz., *Catla catla* (Ham.), *Labeo rohita* (Ham.) and *Cirrhinus mrigala* (Ham.) locally known as catla, rohu and mrigal and grow well in fresh water. These species are highly preferred by the consumer of India and Asian sub-continents and fetches very high price in the market. The pond bottom soil was analyzed for pH, organic carbon, total nitrogen, available phosphorus and available potassium following the standard methods of AOAC (1990). The water was analyzed for ambient water temperature, pH, dissolved oxygen, free carbon dioxide and total alkalinity following the standard methods of APHA (1989). The growths of experimental fishes are studied in terms of length and weight with the help of Scale and Digital balance.

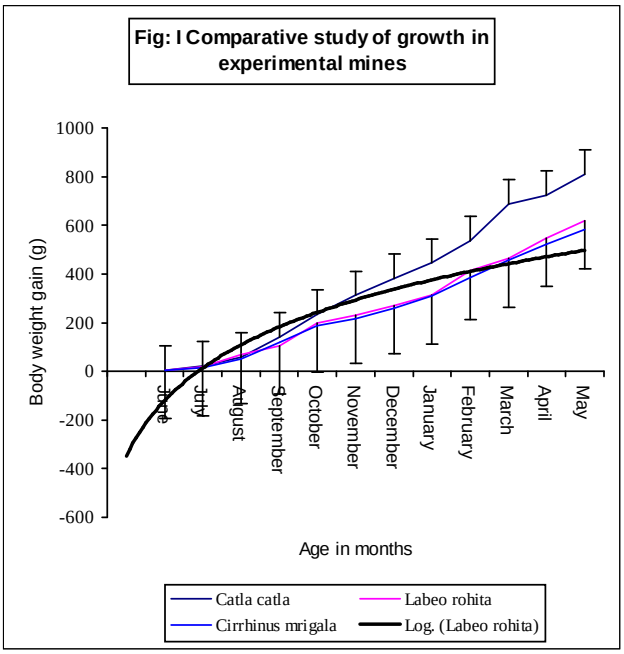
RESULTS AND DISCUSSION

The possibilities of sustainable aquaculture in the pits or 'Khadan' of china clay mines was established by Mandal *et. al.* in 2008. The soil depth was ranged between 8 to 21 mm. Soil quality at the initial stage of experimental china clay mines is unsuitable to carry out the aquaculture practices. The soil was highly alkaline in nature and the pH varied from 9.1 to 9.6 in the experimental 'Khadan'. Though this difference is very little, yet this difference is very important for the growth of Indian major carps. The organic carbon level in experimental 'Khadan' (EP) was found to be 0.003% but in control pond (CP) it was 2.04%. The available phosphorous content at the initial stage was 12.41 ppm in experimental 'Khadan' (EP) and 64.12 ppm in control pond (CP). Available nitrogen content in soil was 1.27 mg 100g $^{-1}$ in experimental 'Khadan' (EP), but in control pond (CP) it was 58.17 mg 100g $^{-1}$. The available potassium content in soil was 20.6 ppm in experimental 'Khadan' (EP) and it was 6.2 ppm in control pond (CP).

Water quality at the initial stage is also unsuitable for carry out the aquaculture practices. The temperature of water was 26.2 ^{o}C in experimental 'Khadan' (EP) and 25.6 ^{o}C in control pond (CP). Dissolved oxygen content in water was 12.2 ppm in EP and 9.0 ppm in CP. Incase of free carbon dioxide it was recorded 8.1 ppm in experimental 'Khadan' (EP) and 4.0 ppm in control pond (CP). Total alkalinity content in water was 267.0 ppm in experimental 'Khadan' (EP) and 118.0 ppm in

Months	Catla catla	Labeo rohita	Cirrhinus mrigala
June	4.2 ± 0.03	4.6 ± 0.53	3.8 ± 0.58
July	21.2 ± 0.21	17.7 ± 0.62	15.3± 0.27
August	57.2 ± 2.43	67.8± 2.19	49.2 ± 1.27
September	142.3 ± 7.21	105.9 ± 0.94	117.9 ± 1.72
October	235.4 ± 6.32	198.3 ± 3.15	186.3 ± 1.45
November	312.1 ± 4.81	231.8 ± 5.51	217.9 ± 3.16
December	383.2 ± 5.33	271.2 ± 7.42	259.8 ± 4.62
January	445.1 ± 4.38	312.6 ± 6.27	308.2 ± 4.31
February	535.7 ± 5.11	413.7 ± 12.11	385.6 ± 4.05
March	687.2 ± 11.25	462.5 ± 11.22	456.8 ± 6.21
April	724.2 ± 12.59	548.2 ± 13.74	521.8 ± 8.22
May	810.6 ± 13.32	620.35 ± 11.51	584.3 ± 4.19

Table 1. Growth of experimental fishes in china clay mines (Weight in Gram and Standard Deviation)

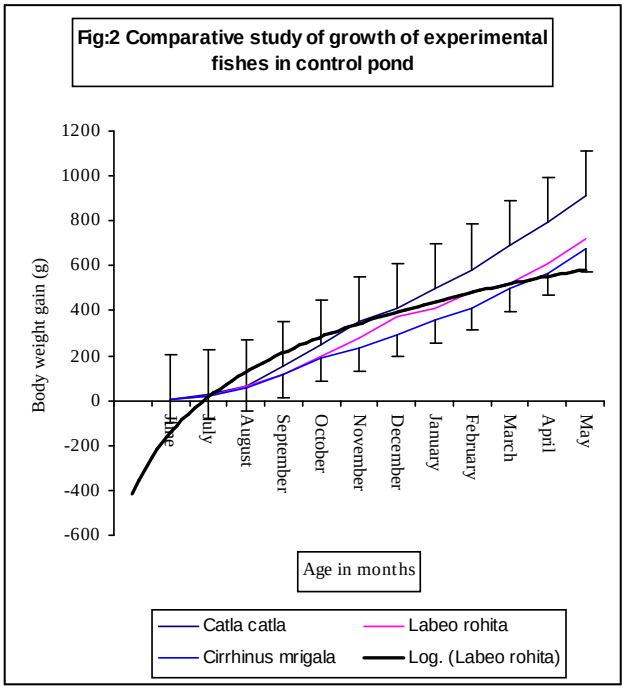


Months	Catla catla	Labeo rohita	Cirrhinus mrigala
June	3.7 ± 0.02	3.6 ± 0.25	3.9 ± 0.21
July	25.4 ± 0.24	21.2 0.39	19.5± 0.41
August	67.6 ± 3.03	66.9± 2.46	53.2 ± 2.21
September	153.8 ± 6.71	113.4 ± 3.78	112.2 ± 3.11
October	245.9 ± 5.35	199.6 ± 5.29	186.5 ± 2.88
November	349.3 ± 4.84	276.8 ± 5.78	231.3 ± 4.32
December	412.6 ± 5.31	372.2 ± 5.45	293.6 ± 5.31
January	496.3 ± 6.32	412.6 ± 4.31	358.2 ± 5.62
February	583.8 ± 7.17	486.4 ± 5.62	411.5 ± 4.97
March	689.3 ± 10.11	521.3 ± 7.11	496.4 ± 5.37
April	792.1 ± 6.55	610.6 ± 5.32	568.3 ± 6.21
May	914.4 ± 8.37	723.9 ± 6.87	673.7 ± 5.37

Table: 2 Growth of experimental fishes in control pond (Weight in Gram and Standard Deviation)

control pond (CP). The pH value was 9.3 and 6.5 in experimental 'Khadan' (EP) and control pond (CP) respectively. Dissolved inorganic nitrogen was 0.0002 ppm in EP and 0.163 ppm in CP. The dissolved phosphorus content in water was 0.0007 ppm in experimental 'Khadan' (EP) and

2.10 ppm in control pond (CP). The dissolved potassium content was 14.2 ppm in experimental 'Khadan' (EP) and 6.1 ppm in control pond (CP). Actually the initial condition of the soil and water of the ' Khadan' was unable to grow of any



aquatic organism especially fish. The soil and water quality was being corrected by periodical application of different types of inorganic fertilizers (Urea, Single Super Phosphate) and organic manures especially cowdung in different doses for 11 months. After proper correction of soil and water parameters experimental fishes were released in to the 'Khadan'. Before starting the experimental trial the pH value was 9.6, but after proper treatment it was decreased to a level of 7.5. Organic carbon (%) at the initial stage of treatment was 0.014%, but after correction it was increased to a level of 0.814%. Initial value of available nitrogen in soil was 1.27 mg $100g^{-1}$, but after treatment it was changed to 52.3 mg $100g^{-1}$. The available phosphorus content in soil at the initial stage was 12.4 ppm, but after correction it was increased to a level of 62.6 ppm. Available potassium before starting the experimental work was 20.6 ppm but after treatment it was reduced to 9.4 ppm. After proper correction of soil, water and biological condition the 'Khadan' (EP) water was used for aquaculture practice and one productive pond at same eco-climatic zone was consider as control (CP). Initial value of pH was 9.3, but after proper correction decreased to a level of 7.21. Dissolved oxygen content was also changed from 12.2 ppm to 7.8 ppm. Initial value of free carbon dioxide was 8.1 ppm, but after correction it was 4.2 ppm. Incase of total alkalinity before correction it was 267.0 ppm, but after correction reduce to 123.0 ppm. Dissolved inorganic nitrogen content was also changed from 0.0002 ppm to 0.230 ppm. Initial value of phosphorus was 0.0007 ppm but after correction increased to a level of 1.9 ppm. Level of potassium before correction was 14.2 ppm but after correction it was decreased to a level of 7.9 ppm. The plankton density was found to very low at the initial stage of experiment i.e. 0.004 ml 45 L^{-1} but at the end of correction for 11 months it was increased to a level of 0.06 ml 45 L^{-1}. The biochemical composition of Indian Major Carp rearing in china clay pits is very much acceptable as compare to the fish culture in productive pond (Mandal *et al.*, 2010).

Growth of experimental fishes in terms of weight gain (g)

It is common practice to compute growth rates over time series data considering different variables. Table-1 represents the result obtained in experimental trial with regards to growth in terms of weight gain (g) of *Catla catla*, *Labeo rohita* and *Cirrhinus mrigala*. After one year experimental trial it has been seen that *Catla* reaches 810.36g, *Labeo* 620.35g and *Cirrhinus* reaches 584.3g. The weight increment was higher during July to November months and the rate decreased in winter months and again increased in spring. Table – 2 represents the data of growth of experimental fishes in terms of weight gain (g) in control pond. The results obtained from 12 months observation indicated that *Catla* (914.4g) perform highest growth as compare to *Labeo* (723.9g) and *Cirrhinus*. (673.7g). Fig: I & 2 represents the comparative trends of growth of experimental fishes in control pond and as well as experimental mines. This figures shows that growth trends of *Catla catla* are higher in control pond than experimental china clay mines as because natural food is in more abundance in control pond. Simultaneously *Labeo rohita* and *Cirrhinus mrigala* shows slow growth rate in experimental china clay mines as compare to growth in control pond. It is therefore, revealed from the discussion that all the condition prevailed during the experimental period are favourable for carps to grow and how effectively the existing pisciculture resources in 'Khadan' areas of West Bengal (Particularly in Birbhum, Bankura and some portion of Midnapore) could be exploited and increased by changing management practices. Whether, it will be profitable or not and can be understood only when it is analysed in relation to cost of production, as pointed out by Pantulu (1974).

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