

ROLE OF RAINFALL IN THE BREEDING OF
LABEO ROHITA (HAM.) *CIRRHINUS MRIGALA* (HAM.), *CATLA CATLA*
(HAM.), AT DAMDAMA (HARYANA), A SEMI-ARID ZONE.

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ABSTRACT

The role of several environmental factors on the breeding and hatching of fish has been worked out by many earlier investigators. Perfection in hypophysation technique helped to some extent in by passing the environmental variables such as temperature, light and rain. With the use of modern fish hatchery, it is possible to attain maximum success in breeding and hatching, even without rains.

INTRODUCTION

Fish spawning is mainly controlled by several environmental factors. Ibrahim *et al.* (1957), Hoar (1959), Chaudhri (1960), Alikunhi *et al.* (1960), Ahsan (1966) and Badami and David (1964) studied the role of environmental factors on the maturation and breeding of fish.

The semi-arid zones in Haryana are characterized by adverse climatic conditions which include low and erratic rainfall, delayed monsoon, higher temperature and less humidity, which do not provide suitable conditions for fish to breed. Efforts were made to breed fish in controlled conditions of hatchery and the effects of rainfall, temperature and oxygen were studied.

According to Khan (1945), Chaudhry (1963) and Alikunhi *et al.* (1964), Indian major carps breed with in a temperature range of 24-31°C. Hora (1945), Saha *et al.* (1957) and Jhingran (1968) are of the view that fresh rain water and flooded conditions in a tank are the primary factors in triggering the spawning of carps. Successful spawning in majority of fishes has been induced on cloudy and rainy days, especially after heavy showers (Chaudhri, 1969). Clemens (1967) stated that pituitary injection to some extent may bypass the environmental variables of temperature, light and rain. The modern fish hatchery

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Model CIFE D-80 & D-81 (Dwivedi and Ravindranathan, 1982) which make use of ground-water (tube well water) has revolutionised seed production of culturable species of major carps.

All experiments were performed in the modern fish hatchery (Model CIFE D-80) unit at Damdama fish seed farm. Breeders of *Catla catla*, *Labeo rohita*, and *Cirrhinus mrigala* were stocked in a 0.07 ha. pond. Breeders were fed on groundnut oil cake and rice bran (1:1) at the rate of 1% of body weight throughout the year. Before first injection, the breeders were acclimatized in a breeding pool of size 6' x 3' having continuous supply of groundwater in the form of shower from overhead tank. The first dose of pituitary extract at 2.0 mg/kg body weight was injected only to the females. Again after an interval of 3-4 hrs, both males and females were injected with the extract at 2.0 mg/Kg and 4.0 mg/Kg respectively. The extract was prepared in distilled water. Glands collected earlier from riverine major carps and stocked in absolute alcohol only were used for this purpose. Breeding success was achieved in all the sets injected. Breeding success was calculated based on the observations that 1 Kg of *Labeo rohita* and *Cirrhinus mrigala* lays 3.00 lakh and *Catla catla* lays 2.00 lakh eggs on an average. Eggs were collected and transferred to the vertical jar hatchery made of LDPE (Low density polyethylene), connected with an inlet at the bottom, and supplied with ground water through an overhead tank.

RESULTS AND DISCUSSION

Fig. 1 shows the relationship between breeding success, fertilization and hatching success against rainfall. Even without any rainfall or very less rains successful breeding and hatching were noted.

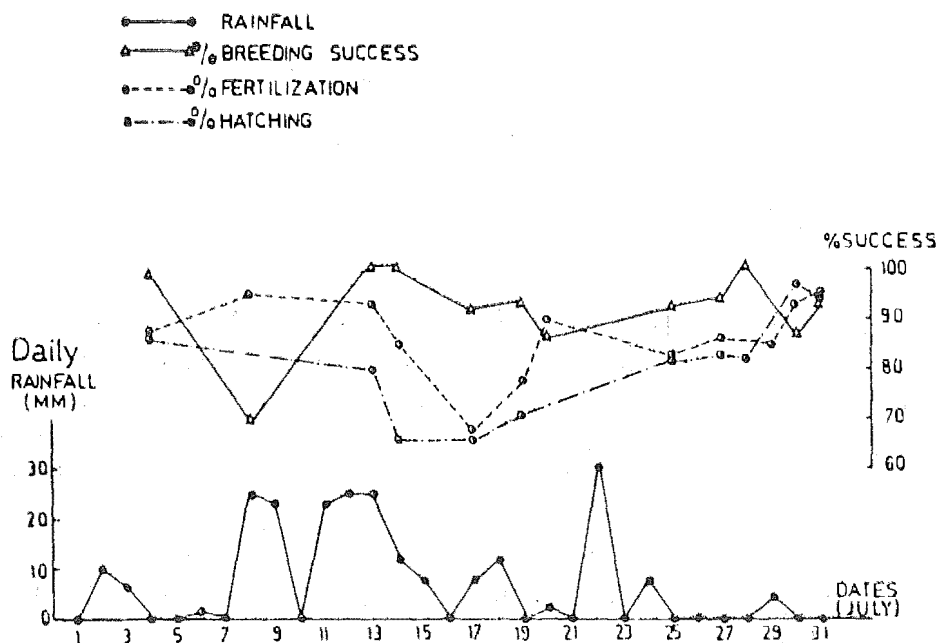


Fig. 1. Breeding of carps and rainfall at Damdama

Table I. Factors controlled for successful breeding of majos carps.

Factors	Range	Mean
Dissolved oxygen (groundwater)	1.7-1.9 mg/l	1.8 mg/l
Dissolved oxygen (overhead tank)	4.8-5.2 mg/l	5.0 mg/l
Dissolved oxygen (breeding pool)	7.5-8.5 mg/l	8.0 mg/l
pH	7.0	7.0
Temperature	26-28°C	27°C
Free CO ₂	Negligible	Negligible
Turbidity	Nil	Nil

 Table II. *Labeo rohita* spawn production at Damdama in 1984

Date	No. of female	Temperature °C hatchery			DO mg/l	Rainfall mm	Breeding success %	Fert. success %	Hatch. success %
		Air	Room	Pool water					
4.7.84	2	35.0	35.0	28.0	8.0	Nil	100	95	84.4
14.7.84	3	34.0	31.0	28.0	8.0	12.70	100	90	59.8
14.7.84	2	34.0	31.0	28.0	8.0	12.70	100	80	71.4
20.7.84	2	37.5	32.0	28.0	8.0	2.54	100	95	---*
20.7.84	2	37.5	32.0	28.0	8.0	2.54	100	90	---*
25.7.84	1	36.0	31.0	28.0	8.0	—	100	80	79.2
25.7.84	1	36.0	31.0	28.0	8.0	—	100	90	97.2
27.7.84	2	35.0	30.0	28.0	8.0	—	100	90	90.8
27.7.84	1	35.0	30.0	28.0	8.0	—	75	90	75.7
27.7.84	1	35.0	30.0	28.0	8.0	—	100	85	73.5
27.7.84	1	35.0	30.0	28.0	8.0	—	100	80	92.9
28.7.84	1	36.0	30.0	28.0	8.0	—	100	85	82.3
30.7.84	1	34.0	30.0	28.0	8.0	—	73.7	90	97.7
30.7.84	1	34.0	30.0	28.0	8.0	—	100	95	97.7
31.7.84	1	33.0	30.0	28.0	8.0	—	100	100	95.7
31.7.84	1	33.0	30.0	28.0	8.0	—	85.7	90	92.7
2.8.84	1	32.0	30.0	28.0	8.0	7.70	100	90	90.9
2.8.84	1	32.0	30.0	28.0	8.0	7.70	100	75	86.5
2.8.84	1	32.0	30.0	28.0	8.0	7.70	68.3	90	90.3
3.8.84	2	34.0	30.0	28.0	8.0	—	100	60	75.8
3.8.84	2	34.0	30.0	28.0	8.0	—	53.3	60	66.9
4.8.84	1	35.0	30.5	28.0	8.0	—	100	80	---*
4.8.84	1	35.0	30.5	28.0	8.0	—	100	75	---*
4.8.84	2	35.0	30.5	28.0	8.0	—	44	75	---*
16.8.84	1	36.0	31.0	28.0	8.0	5.10	100	90	76

* Failure due to shortage of water supply.

Dissolved oxygen and temperature directly influence physiological and metabolic activities of developing eggs and spawn. In natural environments carp eggs get settled at the bottom and are covered by silt. Therefore, there is no direct contact between the embryo and the surrounding water. Decomposition of dead plankton, other water organisms along with other organic matter present in the water also contribute to the rapid decline of dissolved oxygen of water. The amount of DO present in water is inversely related to temperature. So, in natural environment rainfall, brings down the temperature and increases the dissolved oxygen of water, thus, providing optimal conditions for the fish to spawn.

At Damdama (a semi-arid zone) air temperature and water temperature were recorded as high as 42°C and 38°C respectively during the month of July and August 1984. Using the modern fish hatchery model CIFE D-80 (Mitra *et al.* 1983) which make use of tubewell water (temperature $27 \pm 1^\circ\text{C}$). Tube well water fall in the breeding tank in the form of a shower after passing through a filter and a overhead tank. The filter helps in removing any silt particles in the

Table III. *Cirrhinus mrigala* spawn production at Damdama in 1984

Date	No. of female	Temperature °C			DO mg/l	Rainfall mm	Breeding success %	Fert. success %	Hatch. success %
		hatchery							
		Air	Room	Pool water					
23.6.84	2	38.0	32.0	28.0	8.0	—	50	80	62.5
4.7.84	1	35.0	30.0	28.0	8.0	—	100	95	92.5
4.7.84	2	35.0	30.0	28.0	8.0	—	100	85	85.9
4.7.84	2	35.0	30.0	28.0	8.0	—	97	80	83.3
8.7.84	2	32.0	30.0	28.0	8.0	25.40	70	95	---*
13.7.84	3	32.0	30.0	28.0	8.0	25.40	100	90	63.0
17.7.84	2	36.0	31.5	28.0	8.0	7.62	100	80	72.8
17.7.84	2	36.0	31.5	28.0	8.0	7.62	100	80	63.8
17.7.84	1	36.0	31.5	28.0	8.0	7.62	88	60	66.6
17.7.84	1	36.0	31.5	28.0	8.0	7.62	100	60	77.5
19.7.84	1	36.0	32.0	28.0	8.0	—	86	65	71.4
19.7.84	1	36.0	32.0	28.0	8.0	—	100	90	---*
20.7.84	2	37.5	32.0	28.0	8.0	2.54	67	85	---*
20.7.84	2	37.5	32.0	28.0	8.0	2.54	78.5	90	---*
25.7.84	1	36.0	31.0	28.0	8.0	—	74.0	85	82.5
25.7.84	1	36.0	31.0	28.0	8.0	—	78.0	85	82.5
25.7.84	1	36.0	31.0	28.0	8.0	—	100	75	70.9
25.7.84	1	36.0	31.0	28.0	8.0	—	100	80	78.1
4.8.84	2	35.0	30.5	28.0	8.0	—	50.3	80	---*

* Failure due to shortage of water supply.

Table IV. *Catla catla* spawn production Damdama ih 1984

Date	No. of female	Temperature °C			DO mg/l	Rainfall mm	Breeding success %	Fert. success %	Hatch. success %
		hatchery							
		Air	Room	Pool water					
13.7.84	2	32.00	30.00	28.00	8.00	25.40	100	95	86
13.7.84	1	32.00	30.00	28.00	8.00	25.40	100	95	87.8
17.7.84	1	36.00	31.5	28.0	8.00	7.62	78	60	53.19

Table V. Fish spawn production of different carps under controlled conditions from June to Aug. 1984.

Month	Fish	Sets	Total Wt. of female (Kgs)	Temperature °C			Rainfall	Egg/Spawn production (In lakhs)	Survival/Supply (In lakhs)
				Hatchery					
				Air	Room	Pool wat.			
June	Major carps*	1	1000	35-43	25-30	26.0	—	1.50	0.75
July	Major carps	36	55.250	32-37.5	30.32	28.0	48.25	162.893	94.45
August	Major carps	10	10.000	32-36	30-31	28.0	12.80	30.478	11.75
		47	66.250					194.871	106.95

**Labeo rohita*

Cirrhinus mrigala

Catla catla

water and when the water fall in the over head tank from a constant height, the dissolved oxygen of water increases. All these process increases the level of DO from 1.8 mg/l in the tubewell water to 8.0 mg/l in the breeding pool (Table I). The water temperature is maintained at $27 \pm 1^\circ\text{C}$. A continuous flow of water is maintained to keep constant level of DO and temperature.

Fig. 1 and tables II to V show that in the controlled conditions of the hatchery rainfall and enviornmental temperature do not have any relation either with breeding success or hatching success (Dwivedi and Ravindranathan, 1982). On 4th July and 28th July, when there was no rainfall and the average atmospheric temperature was 30°C and 36°C respectively, average breeding success was 99.25 and 100% respectively, with an average hatching success of 86.52 and 82.3% respectively, which is just opposite to that of the 8th July, when rainfall and temperature were 25.40 mm and 32°C respectively with a breeding success of only 70%.

Therefore, it is obvious that fish breeding does not depend on rainfall in controlled conditions of a hatchery where induced breeding is mainly controlled by temperature and dissolved oxygen of water. Thus, it is possible that with the use of the modern fish hatchery large number of fish seed could be produced without rain, even in semi-arid conditions as existing in Damdama (Haryana).

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