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AN OBSERVATION ON INTERGENERIC HYBRIDIZATION BETWEEN *Labeo calbasu* ♀ X *Cirrhinus mirigala* ♂

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ABSTRACT

Performance of intergeneric hybrids obtained through hybridation between *Labeo calbasu* ♀ and *Cirrhinus mrigala* ♂ was evaluated in terms of fertilization, mortality and hatching rates and larval survivality in fish hatchery at Manikgonj. The fishes were bred by administering Pituitary Gland (PG) extract and a total of three pairs of spawners in three separate trials. Observations were made on the growth performance of the hybrid. Ovulation period varied from 3 hrs. 50 mins to 4 hrs. 30 mins. The rates of fertilization varied between 95.3%-96.6%. The incubation period ranged from 12 hrs to 13 hrs with the hatching rates of 87.6% - 93.8% at water temperatures between 30.6° - 32.0° C. It took about 2 hrs from onset of hatching to complete hatching. Egg mortality varied from 8.6% - 40.6%. The larval survival rate (up to 4 days after hatching) ranged from 45.1% ±50% at the temperature of 29.8° -32.0° C. During a one year study period the hybrid attained a length of 45.6% ± 2.106 cm and a weight of 506.445.1 ±15.112g. Growth performance of hybrid in terms of weight was faster than mrigel but slower than calbasu.

Key words: Hybridization, *Labeo calbasu, Cirrhinus mrigala*

INTRODUCTION

Fish is the main source of animal protein in the daily diet of common people through out the country. About 80% of the available protein comes from the fish. The open water fisheries resources are over exploited and many species of fresh water fishes are becoming extinct. This declining is more pronounced in case of large fish, particularly the carps. The carps which earlier comprised 30% of the total catch of the country have now declined to 5% to 6%. This is due to the destruction of open water habitat, over and unmanaged exploitation. The man made and natural factors degraded the natural fish habitat to a great extent. As a result, over all fish production from the open water system is declining and at present it is able to cover only half of the demand.

Fish seed is the unique factor for fish production and development of fisheries. In Bangladesh, still fish seeds are mainly collected from the wild. The seeds collected from natural sources are not free from adulteration on undesirable species or predators. To fulfill the demand of fish seeds it is required to produce fish seed in the hatchery.

Hybridization among strains and subspecies has played a great part in genetic improvement of carp. The hybrids produced very often show high rate of growth, low rate of mortality, high disease resistance and can be used for commercial fish cultivation or production as they possess improved shape and greater fecundity.

Considerable works on hybridization has been carried out in India since the early attempts Chaudhuri (1959). Several interspecific and intergeneric hybrids were made among the Indian major carps: *Catla catla, Labeo rohita, Cirrhinus mrigala and Labeo calbasu* (Chaudhuri 1959, 1971 & 1973 ; Naseem Hamza , 1971; Varghese & Sukumaran, 1971; Chondar 1977) and among those of Indian major carps and exotic carps viz. common carp (Alikunhi and Chaudhuri, 1959; Kowtal and Gupta, 1984) have been artificially produced through hypophysation. In Bangladesh, Fisheries Research Institute (FRI), Mymensingh successfully produced hybrids of *Clarias gariepinus* X *Clarias batrachus* which is acceptable to people and has better performance. Great deals of works are done on the hybridization of

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major carp species, a little has been done on the hybridization between calbasu and mrigel (*Labeo calbasu* ♀ X *Cirrhinus mrigala* ♂). Both the above species are economically important and widely cultured in the country. It was thus decided to make observations on the hybrids obtained through hybridization of the above two genera. How ever, the specific objectives of the study were to bred the above two genera to produce a hybrid of them; to make quantitative study on the fertilization, hatching, incubation period and larval mortality rate.

MATERIALS AND METHODS

Hybridization of the fish was done by artificial breeding of the fish. Information on the fecundity, fertilization rate, hatching rate, larval rearing, survival rate and growth of fish were collected.

The fishes used in the study were female calbasu, *Labeo calbasu* and male mrigel, *Cirrhinus mrigala*. The experimental fishes were paired 1 female: 1 male. Three pairs of fishes were used in the present study. The parent fish came from a same breed of the hatchery. They were brought up to maturity stage in the pond facilities of the hatchery. How ever they were transferred to the brood stock pond 4-5 months prior to hybridization. Hybridization is done through various stages of brood fish management such as stocking of breeders, post stocking management, feeding, and collection and rearing of spawners. The breeding techniques included sexing, condition of the brood, inducing agent, preparation of gland suspension doses for inducing agents, administration of injection, post injection care, hatching, rearing of hatchlings, transferring of larvae and management of nursery ponds etc.

The different formulae used for the different parameters are

Fecundity = (Nos. of eggs counted in the samples × Total weight of egg)/ Weight of eggs sample

Fertilization rate = (Nos. of fertilized eggs in the sample/ Total nos. of eggs in fishes) × 100

The average from the five samples was taken for the study.

Rate of egg mortality = (No. of dead larvae in sample/Total no. of eggs in sample) × 100

Hatching rate= (No. of hatched eggs in the sample/ total no. of egg in the sample) × 100

RESULTS AND DISCUSSION

In the trial 1, 2, 3 the absolute fecundity of the fishes were 5,44,000 (length 42.5 cm, weight 1550 gm); 5,97,000 (length 46.6 cm, weight 1770 gm) and 6,30,000 (length 49.2 cm, weight 1795 gm) and the relative fecundity of fish (no./gm body weight) were 350.97, 351.18 and 350.97, respectively (Table1). The fecundity of *Labeo calbasu* in the present investigation, in an average, was 5, 90,000 with the average body weight of 1.7 kg. However, Rahman (1989) reported that the fecundity ranged between 1, 93,000 to and 2,38,000 in a fish having body length ranging from 38.8-40.5 cm. However, the fecundity of the fish with the same length may vary in the same species.

Ovulation period were 4 hrs 15 mins in trial 1, 3 hrs 30 mins in trial 2 and 4 hrs 30 mins in trial 3. The ovulation period of female *Labeo calbasu* varied little in the three trials. In trial 1, about 4 hrs 15 mins after the second injection of female, it took by that time, the female showed the signs for requiring stripping and about 3 hrs 50 minutes after the the second injection in trial 2, whereas the ovulation period of female in trial 3 was 4 hrs 30 minutes after the second injection.

Table 1. Fecundity, length and weight of female spawner, *Labeo calbasu* used for hybridization in trial 1, 2 and 3

Trial no.	Sample female fish	Body weight of fish(g)	Average body weight of fish(g)	Weight of ovary obtained by striping(g)	Average weight of ovary(g)	Length of fish (cm)	Average length of fish(cm)	Fecundity of fish (F) in thousand	Average fecundity of fish in thousand	Total fecundity per (gm) of body weight	Average fecundity per gm of body weight
1	1	1550		410.3		42.5		544		350.97	
2	2	1700	1681.66	450	445.13	46.6	46.1	597	590.33	351.18	351.04
3	3	1795	±100.857	475.1	±26.677	49.2	± 2.758	630	± 35.424	350.97	± 0.099

Average data are arithmetic mean ±S.D. (N=3)

The ovulation period of *Labeo calbasu* varied from 3 hrs 50 mins to 4 hrs 30 min.
In the first trial in June, 1998, the fertilization rates of egg were 95.57%, while in the trial 2 in June, 1998 and trial 3 in July, 1998, the rates were 94.28% and 96.58%, respectively within 1 hr after mixing of egg and milt (Fig. 1). In the present study in cross breeding between calbasu female and mrigel male, the rate of fertilization was nearly as good as mrigel.

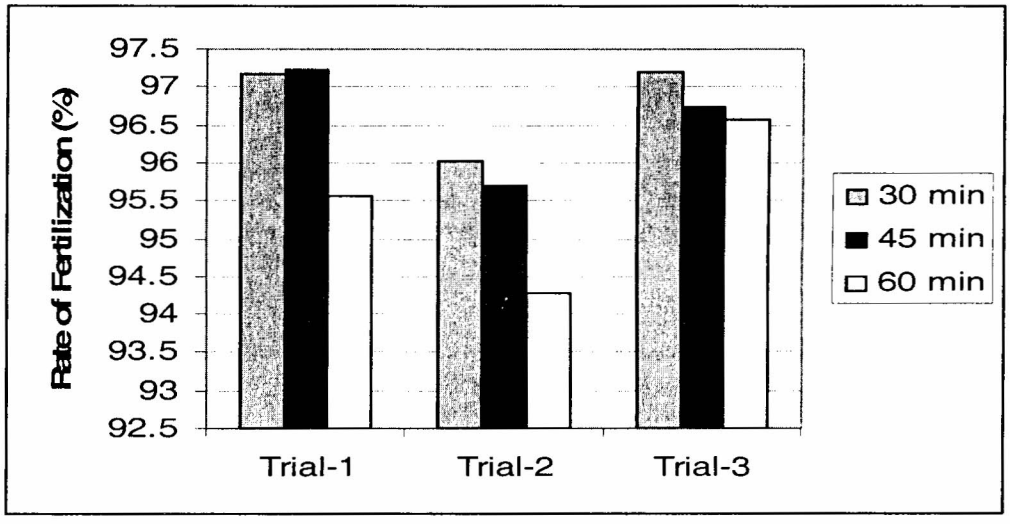

Fig. 1 The fertilization rate of eggs observed during crossing of *C. mrigala X L. calbasu*

The rates of egg mortality during incubation of fertilized eggs were 8.68% in trial 1, 16.83% in trial 2 and 13.5% in trial 3. But after 9 hrs or 10 hrs, the rates reached up 32.75 in trial 1, 40.6% in trial 2 and 38.06% in trial 3 respectively. The maximum mortality occurred in between 2 hrs and 12 hrs after fertilization (Fig. 2). In the present study, the mortality rates of fertilized eggs during incubation were comparatively less (8.6-40.0%) at water temperature of 30-32°C. It may be due to less attack by bacteria, fungi etc and the hatching jar were periodically treated with methylene blue as disinfectant. Khan (1944) also observed the same result with mrigel, where hatching continued up to 19 hrs.

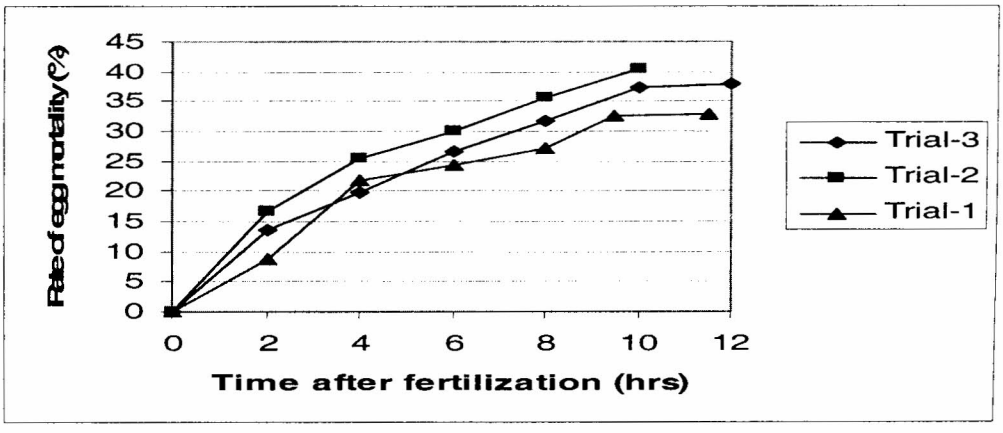

Fig. 2 Rate off egg mortality with increasing time after fertilization

The survival rates of hatchlings in hatching jar were high immediately after hatching 98.97% in trial 1, 95.94% in trial 2 and 98% in trial 3, respectively (Fig.3). In the present investigation the survival rate of hatchlings and larvae up to 5 days reached to 45% with the water temperature ranging from 29.8-32° C. Maximum larval mortality occurred within the first 15 days after hatching and the reason may be the change of water quality or any parasitic, bacterial or fungal infection. Rahman (1989) reported up to 90% survival rate of hybrid production from female *Catla Catla* and male *L. rohita.* Similar observation was reported by Alikunhi and Chaudhuri (1959).

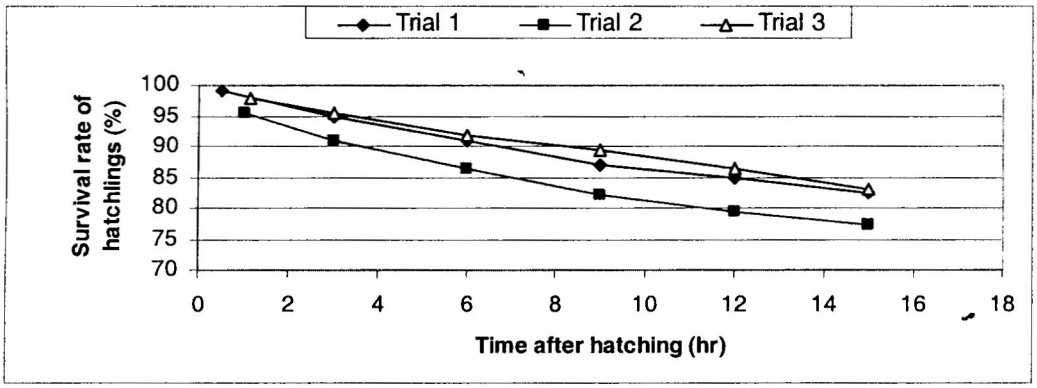

Fig. 3 Survival rate of hatchling during the crossing of C. *mrigala* × *L. calbasu*

The survival rates of larvae in cistern maintained for 4 days from 18 hrs up to 111 hrs after hatching in trial 1, 2 and 3 (Table 2). It was observed that on the first day, of transferring of the larvae from hatching jar to cistern, up to 39 hrs after hatching, the survival rates were 80%, 82.08% and 69.11% in trial 1, 2 and 3. The mortality rate was higher in trial 3 on the first day of transfer to cistern. On the second day of transfer 63 hrs after hatching, the survival rates were 64% in trial 1, 71.06% in trial 2 and 60% in trial 3. In cistern on the third day, the rates of larval survival were 52%, 56.32% and 52.16%, respectively.

Table 2. Rate of larval survival of hybrid larvae obtained during the cross breeding of *C. mrigala* ♂ × *L. calbasu* ♀ in cistern up to 4th day of transfer

Time after fertilization	Trial	Time	Temperature (° C)	Rate of larval survival (%)
18 hrs	Trial-1	11.06 AM	31.2	95.56 ± 0.908
	Trial-2	9.02 AM	30.5	94.33 ± 2.602
	Trial-3	2.05AM	32	81.95 ± 0.897
39 hrs	Trial-1	8.05 PM	31.4	80.00 ± 0.067
	Trial-2	6.02 AM	31.1	82.08 ± 0.987
	Trial-3	11.50AM	31.4	69.11 ± 0.333
63 hrs	Trial-1	8.07 PM	31	64.00 ± 0.942
	Trial-2	6.00 AM	30.6	71.06 ± 0.015
	Trial-3	11.55AM	31.5	60.00 ± 0.616
87 hrs	Trial-1	8.02 AM	31	52.00 ± 1.732
	Trial-2	6.02 AM	30.3	56.32 ± 0.762
	Trial-3	11.50AM	31.3	52.16 ± 0.511
111 hrs	Trial-1	8.05 AM	30.8	47.90 ± 0.991
	Trial-2	6.00 AM	30.2	45.10 ± 0.333
	Trial-3	11.52 AM	31.6	50.00 ± 0.221

Data are arithmetic mean ± S.D. (N=3)

On the fourth day of transfer of larvae in cistern just before release in nursery ponds about 111 hrs after hatching the survival, rate weight down to 47.9% in trial1, 45.10% in trial 2 and 50% in trial 3. However, the survival rate slowed down with the progression of time(Table 2).

The data on the growth performance (length and weight) of hybrid (*L. calbasu* ♀ × *C. mrigala* ♂) for a period of 6 months is shown in Fig. 4 & 5. It was found that in the month of January 1999, the length of *C. mrigala* , *L. calbasu* and their hybrid were 12 cm,13.5 cm and 16 cm, respectively which grew up to 46.2 cm, 32.8 cm and 45.6 cm in the month of July, 1999. The weight of mrigel, calbasu and their hybrid in January was 106.9g, 191.7 g and 159.3 g which attained up to 411.7g, 536.3 g and 466.2g in July, 1999, respectively. At the age of 6 months (in the month of January) the hybrid had an average weight of 237.2± 8.298. At the end of one year the hybrids attained an average length of 45.6± 2.106 cm and a weight of 506.4± 15.112 gm. In the present investigation, the growth performance of hybrid was better than paternal parent (mrigel) but slower than maternal parent (calbasu) (Fig. 6). Similar observation was found by Choudhuri (1971) who reported that rohu ♀ - calbasu ♂ hybrids grew faster than calbasu (paternal parent).

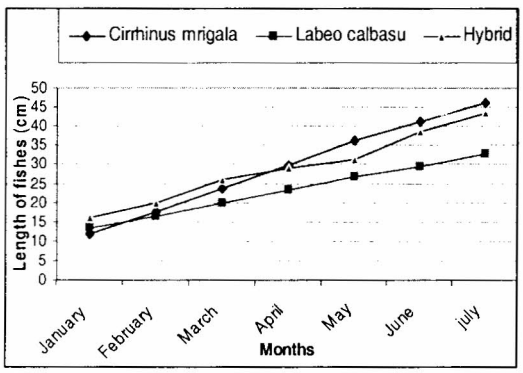

Fig. 4. Monthly changes in growth attainments in hybrid fish and its parents *Cirrhinus mrigala* and *Labeo calbasu*

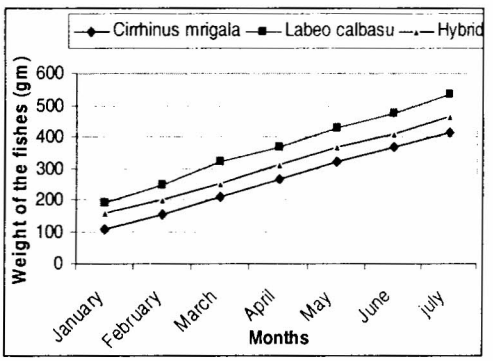

Fig. 5. Monthly changes in growth attainments in hybrid fish and its parents *Cirrhinus mrigala* and *labeo calbasu*

* Due to devastating flood of 1998, the data for the first six months could not be collected.

Fig. 6. Photograph showing the *Labeo calbasu*, *Cirrhinus mrigala* and their hybrid

The present investigation is a basic and an initial type of work. However, the outcome of the study would open a new avenue in the fisheries research of the country. Though the obtained hybrid (*L. calbasu* ♀ × *C. mrigala* ♂) will not be much utility in aquaculture as its quality and growth rate are not better than both of the parents, it would lead to such study in future which would yield better result and will take part in the development of the fisheries sector besides the economics of the country.

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