

Comparative Study of Synthetic Hormones Ovaprim and Carp Pituitary Extract Used in Induced Breeding of Indian Major Carps.

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Abstract: In present study during 2008- 2009 observed the spawning response of ovaprim compared with pituitary extract in Indian major carps, at fish breeding center at Jaikwadi, Paithan Dist. Aurangabad (M.S) India. Total ten trial doses of ovaprim were used in induced breeding and ten trial doses of Carp Pituitary Extract (CPE) used for induced breeding in Indian major carps i.e *Catla catla*, *Labeo rohita* and *Cirrhinus mrigala*. The percentage of fertilization ranged (88.11 - 97.94%) was found with ovaprim treatment. and (53.19 - 85.48%) with pituitary extract treatment. The percentage hatchling ranged (74.70 - 95.92%) with ovaprim treatment and (60 - 58.82%) with pituitary extract treatment.

Key words: Synthetic hormone ovaprim % Carp pituitary extract % Indian major carps and fish breeding

INTRODUCTION

Now a days, science has made wonderful progress in every aspects of techniques including agriculture, aquaculture and explored for the development of common people. Along with other developmental programs, aquacultures stand at the top due to its multidimensional applicability in research and as commodity values. Heavy population growth in India facing several problem of malnutrition and health hazards in common people. To meet out the increasing demand of nutritious food and to get rid malnutrition, scientists are busy to explore the aquatic resource to the maximum to tide over the problem of people.

Fish forms an important source of human diet as they provide proteins, fats and especially vitamins A and D. Specially feature of fish is that they continent of vitamins B, which is not present in the plant food. Fish is the good source of calcium; polyunsaturated fatty acids belonging to linolenic acid series (18:3) are present in fish. Coronary heart diseases patient are required Fish oils. Balanced ratio of T2 linolenic acid (18:3) and T2 linolenic acid (18:2) in fish flesh are found to be useful for mentioning a healthy heart [1].

Fish culture parallel to agriculture. It aims to increase the production of food above the level which would be produced naturally just like agriculture, fish culture includes the ploughing, fertilization, sowing, weed control and eradication of undesirable animals, their replacement by desirable species, the improvement of these species by breeding and selection [2].

Induced breeding means technique of fish breeding in confined water, stimulated by artificial hormone administration, which is a Gonadotropin. In India pituitary hormones were successfully administration to *Catla catla*, *Labeo rohita*, *Cirrhinus mrigala* and spawning were observed. Artificial reproduction and selective breeding producers, gametes preservation has become very popular now a day in the age of science and technology at present.

Various spawning agents have been reported in fishes namely, fish pituitary extract [3-8], human chorionic gonadotropin [9], mammalian pituitary hormone [10], domperidone or pimozide, ovaprim (sGnRHA) [11-13], ovatide [14] and pheromones [15-17]

In present investigation, ovaprim and pituitary extract were used to induce final maturation and spawning in fresh water fishes, *Catla catla*, *Labeo rohita* and *Cirrhinus mrigala* as trial to know the effectiveness of ovaprim is to be compared with pituitary extract.

MATERIALS AND METHODS

The experiments were conducted during June 2008–August 2008 and June 2009–August 2009 (breeding season) at fish breeding center Jaikwadi, Paithan Dist. Aurangabad in Maharashtra state 55 km away from Aurangabad. Total number of 47 females and 56 male *Catla catla*, 54 females and 62 male *Labeo rohita* and 51 females and 60 male *Cirrhinus mrigala* were injected intramuscularly with ovaprim in a single dose, effective dose was found to be 0.2 - 0.3 ml/kg and 0.4 - 0.6 ml/kg body weight of male and female respectively. While total number of 37 females and 47 male *Catla catla*, 38 females and 45 male *Labeo rohita* and 41 females and 50 male *Cirrhinus mrigala* two different dose to female first dose was given 0.2 - 0.4 ml/kg body weight and 0.6 - 0.8 as second dose to female fish were injected intramuscularly with pituitary extract in two doses for females.

Chemicals: Experimentation for the present study the Ovaprim (Syndel laboratories Canada.) was used to induce final maturation, spawning and effectiveness is to be compared with pituitary extract.

Preparation of Pituitary Extract: The pituitary glands were collected from Indian major carp in the month of June to August. To gain access to the pituitary, the top of the skull is removed with a knife. Pituitary gland is left behind on the base of the skull. Collected pituitaries were homogenized in 0.6% salt solution or distilled water. The solution is centrifuged and the clear supernatants were used for injection. Some times preserved pituitary gland may also be used for extract preparations. Pituitary glands were preserved in absolute alcohol immediately after collection. Each gland was kept in a separate phial with fresh absolute and stored in a cool shady place at room temperature or under refrigeration until needed.

Experimental Methodology: The most of the breeding experiment were conducted in cloth hapas. The general size of cloth hapas are 2.5 x 1.2 x 1 m. cloth hapas were fixed in earthen ponds or Bangla bundh.

The present experiments were conducted in circular Chinese hatchery. It is the most popular circular hatchery developed in China during 1960. This system adopted all over the country. This system possesses principle components viz breeding pool, hatching pool, overhead tank, spawn and eggs collection chamber.

Selection of Brooders for Experiment: It is very most important for induced breeding experiment. Healthy and

disease free brooders of *Catla catla*, *Labeo rohita* and *cirrhinus mrigala* of 2-5 years old are selected for every trial in the weight ratio of (1:1) male and female (kg). For the collection of brooders drag net was used for netting (to avoid gill injury). Brooders fishes were identified and selected for the experiment on the basis of following morphological characteristics, such as, the bulging abdomen, soft ventral abdominal region, comparatively larger size, felt pectoral spine, smooth pectoral fin and swelling anal fin with reddish colour of females. But in comparison to males the normal abdomen, milt comes out with gentle pressure on the abdomen, smaller size of similar age, serrated pectoral spine, rough pectoral fin and concave anus from exterior was found.

Methods of Injection: The selected brooders were kept in breeding pool for acclimatization. They were made to fast for 4-6 hrs before injection to release fecal matter out side the body and easy for spawning. Brooders were one by one netted out in hand net. They were placed on a cloth and carefully injected avoiding wriggling movement. There are several ways of hormone administration to matured carps such as intracranial, intra -peritoneal and intramuscular. Some time intra - peritoneal injection is administered at the base of pectoral fin. While intramuscular injection was given at the base of caudal fin above the lateral line in our every trial.

Injected brooders were released in a breeding pool. Experimental brooders were observed for 36 hrs. After injection, Fishes give interval of 4 to 6 hrs the response to behavioral changes, ovulation and spawning etc. For the hatching of eggs, Incubation or hatching pool was used which is circular cemented tank. Ovaprim was used to induce in the present study for comparisons with pituitary extract.

Methods for Assessment of Result

Counting of Egg: The eggs of Indian major carps are non-floating, non-adhesive and round in shape, average diameter of eggs and color of eggs are varies from species to species i.e *Catla catla* 4.6 mm and color is light red, *Labeo rohita* 3.78 mm and color is reddish, *Cirrhina mrigala* 5.5 mm and color is bluish [18] The eggs were collected in a bucket they put in a mosquito net held in water. The eggs were measured in beaker of known volume. Total number of eggs laid (approx) can easily calculated by following formula

$$\text{Total no. of eggs Laid (approx)} = \frac{\text{Average no. of eggs in each sample beaker} \times \text{number of beakers of eggs}}$$

Percentage of Fertilization: Fertilized eggs of Indian major carps are transparent, non-adhesive, round in shape while unfertilized eggs are opaque. The fertilization rate was calculated through random sampling by examining 2-3 samples from each breeding tank by using following formula.

$$\text{Fertilization rate (\%)} = \frac{\text{Average no. of fertilized Eggs in a sample}}{\text{Average no. of eggs in a sample}} \times 100$$

Percentage of Hatchling: Percentage of hatchling was calculated by following formula

$$\text{Hatchling \%} = \frac{\text{Total no. of spawn}}{\text{Total no of fertilized eggs}} \times 100$$

RESULTS

In present study from June - August 2008 and June - August 2009 (breeding season). The result of the experiment carried on Indian major carps i.e *Catla catla*, *Labeo rohita* and *Cirrhinus mrigala* treated with ovaprim and pituitary extract has been presented in table 1,2 and overall effect of ovaprim and pituitary extract are shown in table 3 and 4.

In Catla Catla: Total 47 females of *Catla catla* treated with ovaprim the effective dose was found to be 0.2-0.3 ml/kg and 0.4- 0.6 ml/kg body weight of male and female respectively were induced spawning after 10-12 hrs of injection. The percentage of fertilization observed was (92-96.02%) found and percentage of hatchling (89.31- 95.17%) was found when treated with ovaprim and Overall percentage of fertilization and percentage of hatchling observed was (94.20%) and (92.05%) respectively (Table 1&3, figure 1&4).

Similarly, total 37 females of *Catla catla* were injected with pituitary extract twice in two different dose to female first dose was given 0.2-0.4 ml/kg body weight and 0.6 - 0.8 as second dose to female fish. The time interval between the two successive doses was 6 hrs. Spawning occurred after 6 hrs of second dose. The percentage of fertilization was (69.38- 85.29%) was found and percentage of hatchling (58.82- 78.82%) found when treated with pituitary extract and Overall percentage of fertilization and percentage of hatchling observed was (77.12%) and (68.25%) respectively (Table 2&4, figure 1&4).

In Labeo Rohita: Total 54 females of *Labeo rohita* treated with ovaprim the effective dose was found to be 0.2-0.3 ml/kg and 0.4- 0.6 ml/kg body weight of male and female

Table 1: Spawning response of female Indian major carps with Ovaprim

Species	Month	No. of female treated	Total wt of female (kg)	Average no. of eggs obtained	Dose of ovaprim	Average no. of fertilized eggs	Total no. of hatchling	Average no. eggs Kg ⁻¹	Average no. fertilized eggs KgG ¹	Average no. Hatchling eggs KgG ¹	Average fertilization rate (%)	Average Hatchli rang rate (%)	
Catlacatla	June 08	5	17.0	1620000	0. 4-0.6	1500000	1350000	140000	88235.29412	79411.76471	92.59259	90	
	July 08	4	12.0	1450000	0.4 - 0.6	1370000	1230000	95294.11765	114166.6667	102500	94.48276	89.78102	
	July 08	4	16.0	1760000	0.4 - 0.6	1690000	1560000	120833.3333	105625	97500	96.02273	92.30769	
	Aug.08	4	19.0	2300000	0.4 - 0.6	2116000	1890000	110000	111368.4211	99473.68421	92	89.31947	
	Aug.08	5	20.5	2000000	0.4 - 0.6	1900000	1790000	121052.6316	92682.92683	87317.07317	95	94.21053	
	June 09	5	18.0	1700000	0.4 - 0.6	1595000	1440000	97560.97561	88611.11111	80000	93.82353	90.28213	
	July 09	5	17.5	2015000	0.4 - 0.6	1914000	1800000	94444.44444	109371.4286	102857.1429	94.98759	94.04389	
	July 09	5	20.0	2450000	0.4 - 0.6	2280000	2170000	115142.8571	114000	108500	93.06122	95.17544	
	Aug.09	5	19.5	2200000	0.4 - 0.6	2112000	1964000	122500	108307.6923	100717.9487	96	92.99242	
	Aug.09	5	20.5	2210000	0.4 - 0.6	2080000	1930000	112820.5128	101463.4146	94146.34146	94.11765	92.78846	
	Labeorohita	June 08	7	11.0	2860000	0.4 - 0.6	2520000	2090000	260000	229090.9091	190000	88.11189	82.93651
		July 08	5	9.5	2375000	0.4 - 0.6	2210000	2120000	250000	232631.5789	223157.8947	93.05263	95.9276
July 08		5	10.5	1925000	0.4 - 0.6	1850000	1710000	183333.3333	176190.4762	162857.1429	96.1039	92.43243	
Aug.08		5	9.0	2520000	0.4 - 0.6	2390000	2110000	280000	265555.5556	234444.4444	94.84127	88.28452	
Aug.08		5	11.5	3280000	0.4 - 0.6	3120000	3000000	285217.3913	271304.3478	260869.5652	95.12195	96.15385	
June 09		6	12.0s	3040000	0.4 - 0.6	2790000	2500000	253333.3333	232500	208333.3333	91.77632	89.60573	
July 09		5	9.5	3050000	0.4 - 0.6	2910000	2730000	321052.6316	306315.7895	287368.4211	95.40984	93.81443	
July 09		5	10.0	2500000	0.4 - 0.6	2380000	2150000	250000	238000	215000	95.2	90.33613	
Aug.09		5	9.0	2850000	0.4 - 0.6	2680000	2390000	316666.6667	297777.7778	265555.5556	94.03509	89.1791	
Aug.09		6	14.5	3900000	0.4 - 0.6	3820000	3630000	268965.5172	263448.2759	250344.8276	97.94872	95.02618	
Cirrhinusmrigala		June 08	7	13.0	1820000	0.4 - 0.6	1700000	1270000	140000	130769.2308	97692.30769	93.40659	74.70588
		July 08	4	8.5	1445000	0.4 - 0.6	1270000	1225000	170000	149411.7647	144117.6471	87.88927	96.45669
	July 08	5	10.5	1735000	0.4 - 0.6	1561000	1370000	165238.0952	148666.6667	130476.1905	89.97118	87.76425	
	Aug.08	4	7.5	1300000	0.4 - 0.6	1235000	1100000	173333.3333	164666.6667	146666.6667	95	89.06883	
	Aug.08	5	11.5	2090000	0.4 - 0.6	2000000	1800000	181739.1304	173913.0435	156521.7391	95.69378	90.0	
	June 09	6	10.5	1520000	0.4 - 0.6	1370000	1150000	144761.9048	130476.1905	109523.8095	90.13158	83.94161	
	July 09	5	9.5	1500000	0.4 - 0.6	1390000	1225000	157894.7368	146315.7895	128947.3684	92.66667	88.1295	
	July 09	5	11.5	1725000	0.4 - 0.6	1655000	1530000	150000	143913.0435	133043.4783	95.94203	92.44713	
	Aug.09	5	9.0	1490000	0.4 - 0.6	1400000	1190000	165555.5556	155555.5556	132222.2222	93.95973	85	
	Aug.09	5	10.0	1600000	0.4 - 0.6	1510000	1450000	160000	151000	145000	94.375	96.02649	

Table 2: Spawning response of female Indian major carps with Pituitary extract.

Species	Month	No. of female treated	Total wt of female (kg)	Average no. of eggs obtained	Dose of ovaprim		Average no. of fertilized eggs	Total no. of hatching	Average no. eggs KgG ¹	Average no. fertilized eggs KgG ¹	Average no. Hatchling eggs KgG ¹	Average fertilization rate (%)	Average Hatchling rate (%)
					I st	II nd							
CatlaCatla	June 08	5	17.5	1300000	0.2-0.4	0.6-0.8	970000	630000	74285.7143	55428.57143	36000	74.61	64.94
	July 08	4	16.5	1300000	0.2-0.4	0.6-0.8	1000000	690000	78787.8788	60606.06061	41818.18	76.92	69
	July 08	4	16.5	1200000	0.2-0.4	0.6-0.8	930000	635000	72727.2727	56363.63636	38484.84848	77.5	68.27
	Aug.08	3	12.0	980000	0.2-0.4	0.6-0.8	680000	400000	81666.6667	56666.66667	33333.33333	69.38	58.82
	Aug.08	6	21.5	1700000	0.2-0.4	0.6-0.8	1450000	1135000	79069.7674	67441.86047	52790.69767	85.29	78.82
	June 09	3	10.5	780000	0.2-0.4	0.6-0.8	570000	380000	74285.7143	54285.71429	36190.47619	73.07	66.66
	July 09	2	7.0	535000	0.2-0.4	0.6-0.8	420000	300000	76428.5714	60000	42857.14286	78.50	71.42
	July 09	4	13.0	900000	0.2-0.4	0.6-0.8	720000	510000	69230.7692	55384.61538	39230.76923	80	70.83
	Aug.09	3	10.5	830000	0.2-0.4	0.6-0.8	650000	430000	79047.619	61904.7619	40952.38095	78.31	66.15
	Aug.09	3	12.0	850000	0.2-0.4	0.6-0.8	660000	450000	70833.3333	55000	37500	77.64	68.18
LabeoRohita	June 08	5	12.0	1750000	0.2-0.4	0.6-0.8	1350000	950000	145833.333	112500	79166.66667	77.14	70.37
	July 08	4	10.5	2500000	0.2-0.4	0.6-0.8	2000000	1450000	238095.238	190476.1905	138095.2381	80	72.5
	July 08	5	10.0	1700000	0.2-0.4	0.6-0.8	1390000	990000	170000	139000	99000	81.76	71.22
	Aug.08	3	8.0	1300000	0.2-0.4	0.6-0.8	1030000	730000	162500	128750	91250	79.23	70.87
	Aug.08	5	10.5	1600000	0.2-0.4	0.6-0.8	1360000	1030000	152380.952	129523.8095	98095.2381	85	75.73
	June 09	3	7.5	1150000	0.2-0.4	0.6-0.8	900000	600000	153333.333	120000	80000	78.26	66.66
	July 09	3	8.0	1250000	0.2-0.4	0.6-0.8	860000	535000	156250	107500	66875	68.8	62.20
	July 09	4	8.5	1280000	0.2-0.4	0.6-0.8	1050000	780000	150588.235	123529.4118	91764.70588	82.03	74.28
	Aug.09	3	6.5	1000000	0.2-0.4	0.6-0.8	800000	510000	153846.154	123076.9231	78461.53846	80	63.75
	Aug.09	3	8.0	980000	0.2-0.4	0.6-0.8	770000	530000	122500	96250	66250	78.57	68.83
Cirrhinamrigla	June 08	5	12.0	940000	0.2-0.4	0.6-0.8	500000	300000	78333.3333	41666.66667	25000	53.19	60
	July 08	5	10.5	790000	0.2-0.4	0.6-0.8	630000	450000	75238.0952	60000	42857.14286	79.74	71.42
	July 08	5	9.0	700000	0.2-0.4	0.6-0.8	580000	430000	77777.7778	64444.44444	47777.77778	82.85	74.13
	Aug.08	3	5.5	450000	0.2-0.4	0.6-0.8	360000	270000	81818.1818	65454.54545	49090.90909	80	75
	Aug.08	6	13.5	1030000	0.2-0.4	0.6-0.8	860000	650000	76296.2963	63703.7037	48148.14815	83.49	75.58
	June 09	3	6.0	550000	0.2-0.4	0.6-0.8	470000	360000	91666.6667	78333.33333	60000	85.45	76.59
	July 09	4	8.0	730000	0.2-0.4	0.6-0.8	560000	380000	91250	70000	47500	76.712	67.85
	July 09	4	9.0	560000	0.2-0.4	0.6-0.8	450000	340000	62222.2222	50000	37777.77778	80.35	75.55
	Aug.09	3	7.0	750000	0.2-0.4	0.6-0.8	590000	450000	107142.857	84285.71429	64285.71429	78.66	76.27
	Aug.09	3	7.0	620000	0.2-0.4	0.6-0.8	530000	420000	88571.4286	75714.28571	60000	85.48	79.24

Table 3: Effect of ovaprim on spawning on Indian major carps.

Species	Number of female treated	Total wt of female (kg)	Total no. of eggs	Total no. of fertilized	Total no. of hatchling	Average no. eggs KgG ¹	Average no. fertilized eggs KgG ¹	Average no. Hatchling eggs KgG ¹	Overall fertilization %	Overall Hatchling %
L. rohita	54	106.5	28300000	26670000	24430000	266856.88	251281.47	229793.11	94.06	91.36
C. mrigala	51	101.5	16225000	13291000	13310000	160852.27	149468.79	132421.14	92.89	88.34

Table 4: Effect of pituitary extract on spawning on Indian major carps.

Species	Number of female treated	Total wt of female (kg)	Total no. of eggs	Total no. of fertilized	Total no. of hatchling	Average no. eggs KgG ¹	Average no. fertilized eggs KgG ¹	Average no. Hatchling eggs KgG ¹	Overall fertilization %	Overall Hatchling %
L. rohita	38	89.5	14510000	11570000	8105000	160532	160532.72	88895.83	79.07	69.64
C. mrigala	41	87.5	7120000	5530000	4050000	83031	65360	48243.74	78.59	73.16

respectively which induced spawning after 10-12 hrs of injection. The percentage of fertilization was (88.11-97.94%) was found and percentage of hatchling (82.93-96.15) was found when treated with ovaprim. and Overall percentage of fertilization and percentage of hatchling observed was (94.06%) and (91.36%) respectively (Table 1&3, figure 2&5).

Similarly, total 38 females of *Labeo rohita* were injected with pituitary extract twice in two different dose

to female first dose was given 0.2-0.4 ml/kg body weight and 0.6 - 0.8 as second dose to female fish. The time interval between the two doses was 6 hrs. Spawning occurred after 6hrs of second dose. The percentage of fertilization was (68.8 – 85%) was found and percentage of hatchling (62.20-75.73%) was found when treated with pituitary extract and Overall percentage of fertilization and percentage of hatchling observed was (94.06%) and (91.36%) respectively (Table 2&4, figure 2&5).

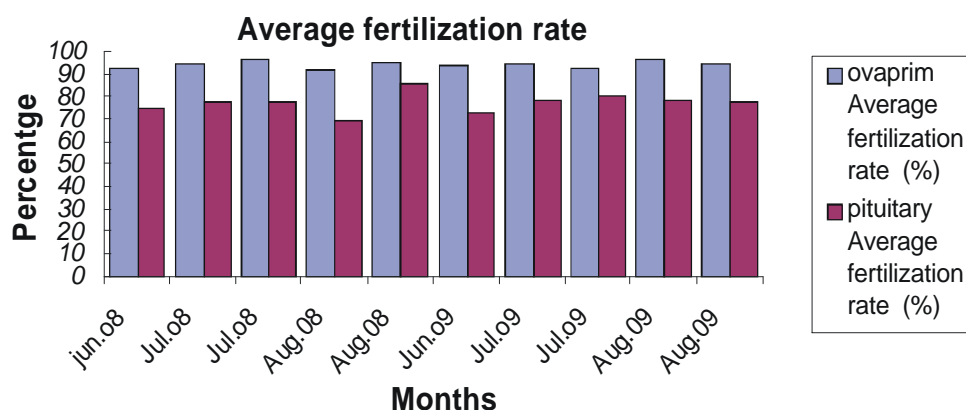


Fig. 1: Shows average fertilization rate (%) in *Catla catla* Ovaprim compared with pituitary extract

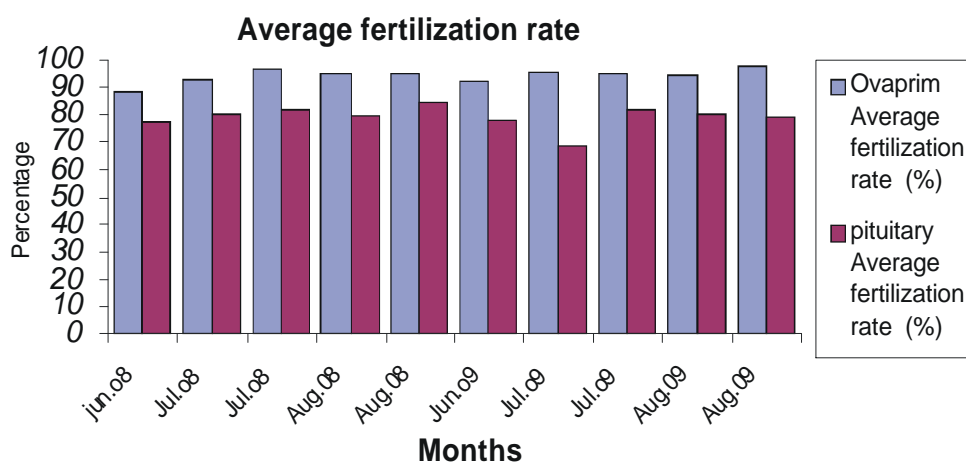


Fig. 2: Shows average fertilization rate (%) Ovaprim compared with pituitary extract in *Labeo rohita*

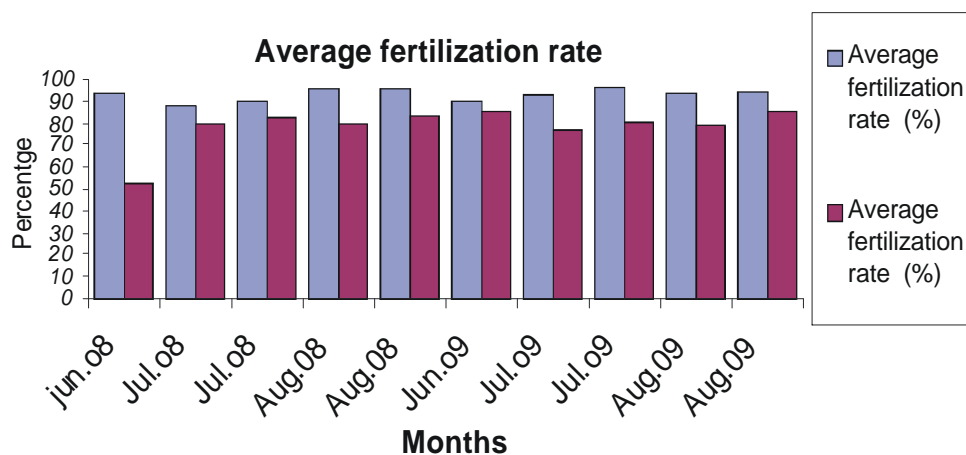


Fig. 3: Shows average fertilization rate (%) Ovaprim compared with pituitary extract in *Cirrhinus mrigala*.

In *Cirrhinus Mrigala*: Total 51 females of *Labeo rohita* treated with ovaprim the effective dose was found to be 0.2-0.3 ml/kg and 0.4- 0.6 ml/kg body weight of male and female respectively which induced spawning after 10-12 hrs of injection. The percentage of fertilization was

(87.88-95.94) was found and percentage of hatchling (74.70-96.45%) was found when treated with ovaprim and Overall percentage of fertilization and percentage of hatchling observed was (92.89) and (88.34) respectively (Table 1&3, figure 3&6).

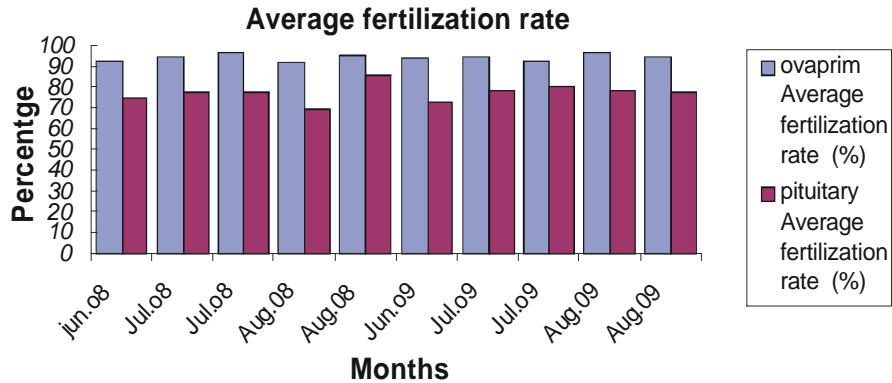


Fig. 4: Shows average hatchling rate (%). Ovaprim compared with pituitary extract in *Catla catla*.

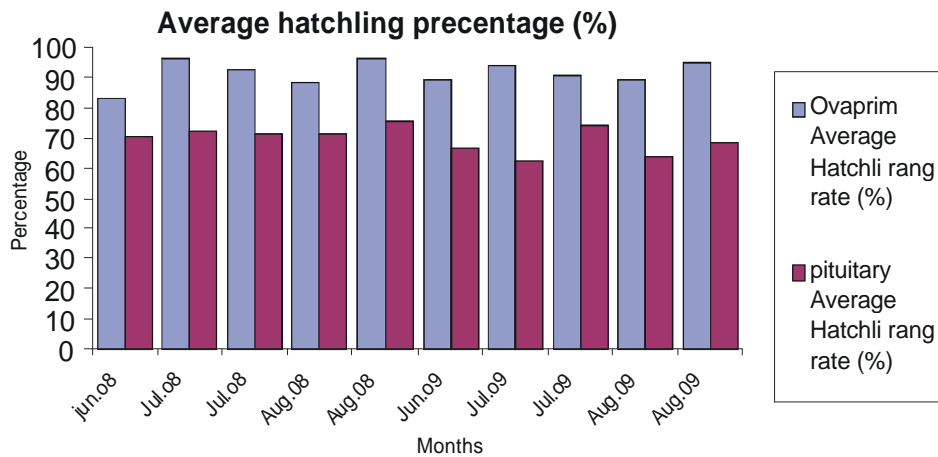


Fig. 5: Shows average hatchling rate (%)Ovaprim compared with pituitary extract in *Labeo rohita*.

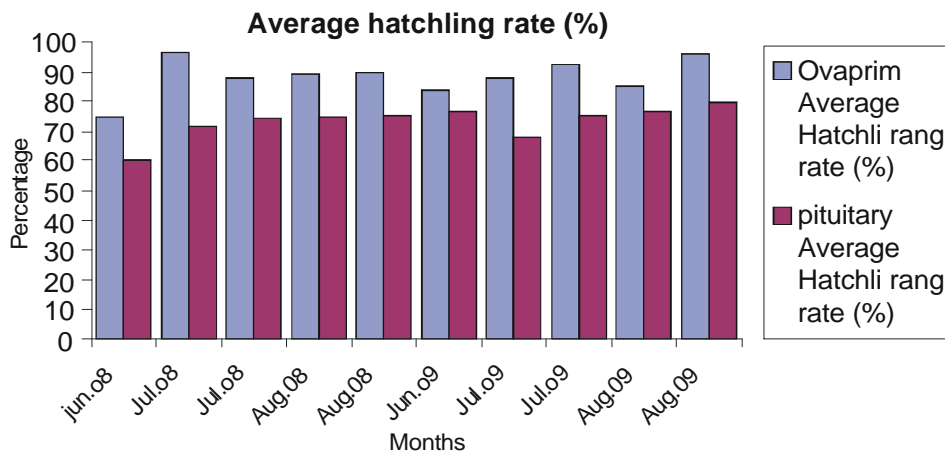


Fig. 6: Shows average hatchling rate (%) . Ovaprim compared with pituitary extract in *Cirrhinus mrigala*.

Similarly, total 41 females of *Cirrhinus mrigala* were injected with pituitary extract twice in two different dose to female first dose was given 0.2-0.4 ml/kg body weight and 0.6 - 0.8 as second dose to female fish. The time interval between the two doses was 6 hrs. Spawning occurred after 6hrs of second dose.

The percentage of fertilization was (53.19%-85.48%) was found and percentage of hatchling (60-79.24%) was found when treated with pituitary extract and Overall percentage of fertilization and percentage of hatchling observed was (94.06%) and (91.36%) respectively (Table 2&4, figure 3&6).

DISCUSSION

[19] has reported overall fertilization percentage (91.01%), overall hatchling percentage (67.50%), average number of egg Kg⁻¹ (67670), average number of fertilized egg Kg⁻¹ (61620), average number of hatchling Kg⁻¹ (41584) in *Catla catla*.

The rate of fertilization and hatchling percentage are generally higher with ovaprim as compared to pituitary extract. [20 & 21] The number of eggs obtained 2,40,000 with fertilization percentage 90 and hatchling percentage 90 in *Labeo rohita* and 1,40,000 with fertilization percentage 95 hatchling percentage 80 in *Cirrhinus mrigala*. [22]. Present study showed that, the result of fertilization and hatchling percentages were higher in Ovaprim treatment compared to pituitary extract treatment. [23] has reported 28 – 100% fertilization in *C. striatus* with regard to pituitary extract and [24] reported 45% fertilization in *H. fossilus*. [25] has noticed percentage of fertilization 60-68% with regard to pituitary extract and percentage of fertilization (95-98%) with regard to Ovaprim. In terms of fertilization and hatchling, ovaprim yielded better result. [26] The highest percentage of fertilization (95 - 98%) was observed in ovaprim treatment *C. Striatus* and in *mrigal* injected with ovaprim, 90% fertilization was observed by [27 & 28] observed the highest percentage of fertilization (87.00%) and the highest percentage of hatchling (87.33%) at 27-28°C in *Labeo bata* with pituitary extract treatment.

CONCLUSIONS

Based on present study it is consequently concluded that the rate of fertilization and hatchling were generally higher in ovaprim when compared to pituitary extract. Reduced handlings of brood fish due to the single dose administrated to both the sexes at the same time due to this decrease post spawning mortality of fish and increase spawning response in ovaprim treatment when compared to pituitary extract treatment.

ACKNOWLEDGEMENTS

The authors are thanks to Head, Department of Zoology Dr. Babasaheb Ambedkar Marathwada University, Aurangabad (Maharashtra state) for providing laboratory facilities. Also, the authors are thankful to the former Assistant fishery Development officer Ghushige, Sapkal and R. Kamble and Assistant fishery Development officer Patel madam for providing facilities during the study.

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