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Comparative Study of Synthetic Hormones Ovaprim and Pituitary Extract in Induced Breeding of Indian Major Carps (Imc)

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Abstract:
In the present study during June 2020- May 2021 observed the spawing response of ovaprim compard with pituitary extract in Indian major carps (IMC). The research work was carried out at fish breeding center, Jayakwadi Paithan 60 K.M away from Aurangabad (M.S) India. Total 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.

Keywords: Synthetic hormone ovaprim ● Carp pituitary extract ● Indianmajor carps and fish breeding.

Introduction:

Due to advancement in science and technology now a days, science has made wonderful progress in every aspects of techniques including agriculture, aquaculture, sericulture fish culture and explored for the development of common people. Along with other developmental programmes aquacultures stand at the top due to multidimensional applicability in research and as commodity values. Heavy populationgrowth in India facing several problems of malnutrition and health hazards in common people. To mitigate the increasing demand of nutritious food and to get rid of malnutrition scientists are busy to explore the aquatic resource to the maximum to tide over the problem of people.
Fish serves as an important source of human diet as they provide proteins, fats especially vitamins A andD special feature of fish is that they contain vitamin B which is not present in the plant food. fish is the good source of calcium polysaturated fatty acids belonging to linolenic acid series (18:3) are present in fish coronary heart diseases patient required fish oils. Balanced ratio of ω^2 linolenic acid (18:3) and linolenic acid (18:2) in fish flesh are found to be useful for mentioning healthy heart [1]
Fish culture is 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 those species by breeding and selection [2 and 33]

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

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

In present investigation ovaprism 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 2020 August 2020 and June 2021 – August 2021 (breeding season) at fish breeding center Jayakwadi, Paithan Dist- Aurangabad in Maharashtra state 55 km away from Aurangabad.

Total number of 47 females and 56 females *Catla catla* 54 females and 62 males *Labeo rohita* and 51 femals and 60 males, *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 - 0.6ml/kg body weight male and female respectively. While total numbers of 37 females and 47 males *Catla catla,* 38 females and 45 male *Labeo rohita* and 41 males and 50 females *Cirrhinus mrigala* two different dose to femals first dose was given 0.2 -0.4 ml/kg body weight and 0.6-0.8 as second dose to female fish were injectedintramuscularly with pituitary extractin two doses for females.

Chemicals:

In the experimentation for the present study the ovaprim (syndel laboratories canada) was used to induce final maturation spawning and effectiveness was compared with pituitary extract.

Preparation of PituitaryExtract:

The pituitary glands were collected from Indian major carps inthe 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 skull. Collected pituitaries werehomogenized in 0.6 % salt solution or distilled water. The solution is centrifuged and the clear supernatants were used for injection. Sometimes 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 phialwith fresh absolute alcohol and stored in a cool shady place at room temperature or under refrigeration untilneeded.

Experimental Methodology

The most of the breeding experiments were conducted in clothhapas. The general size of cloth hapas are

2.5 X 1.2 X 1m cloth hapas were fixed in earthen ponds or Banglabundh. The present experiments were conducted in circular 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, spawnand egg collection chamber.

Selection of Brooders for Experiment

It is 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 wed for netting (to avoid gill injury). Brooder fisheswere identified and selected for the experiment on the basis of following morphological characteristics as the bulging abdomen, soft ventralabdominal region, comparatively large size, felt pectoral spine, smooth pectoral fin and swelling anal fin with reddish colour of females. But incomparison 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 keftin breeding pool for acclimatization. They were made to fast for 4-6 hrs before injection to release fecal matter outside the body and easy for spawning. Brooders were one by one netted out in hand net. They were placed on a cloth are carefully injected avoiding wriggling movement. There are several ways of hormone administration to matured carps such as intracranial, intraperitoneal and 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 behavioural 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 ResultCounting of Egg:

The eggs of Indian Major carps are non floating, non-adhesive and round in shape, average diameter of eggs and colour of eggs are varies from species to species i.e *Catla catla* 4.6mm and color is light red, *Labeorohita* 3.78mm and colour is reddish.*Cirrhinus mrigala* 5.5mm and colour is bluish [18]. The eggs were collected in a bucket they put in a mosquito net held in water. The eggs laid (approx) can easily calculated by following formula.

Total no of Eggs Laid(Approx) = Average no of egge in each sample beaker X Number ofbeakers 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.

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

Percentage of Hatchling:

Percentage of Hatchling was calculated by following formula

Hatchling (%) = $\frac{\text{Total No.of Spawn}}{\text{Total no of Fertilized eggs}} x\ 100$

Results:

In present study carried out form June to August 2020 and June to August 2021 (breeding season The results of the experimentation carried out Indian major carps i.e. *Catla catla, Labeo rohita* and *Cirrhinus mrigala* treatedwith ovaprim and pituitary extract has been presented in table no 1,2 and overall effect of ovarprim and pituitary extract are shown in table 3 and 4

Catla catla:

Total 47 females of *Catla catla* treated with ovaprim the effective dosewas found to be 0.2-0.3 ml/kg and 0.4 -

0.6 ml/kg body weight of male and female respectively. They were induced spawning after 10-12 hrs. The percentage of fertilization observed and recorded was (92-96.02%) and percentage of hatchling (89.31-95.17%) was observed and recorded. when both male and female were treated with ovaprim and overall percentage of fertilization and percentage of hatchling observed and recorded was (94.05%) and (92.05 %) respectively (table no-1 and 3, figure 1 and 4) Similarly total 37 females of *Catla catla* were injected with pituitary extract twice in two different dose to female. The 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 started after 6 hrs of second dose. The percentage of fertilization was (69.38- 85.29%) and the percentage of hatchling was (58.82-78.82%) .

When treated with pituitary extract. The overall percentage of fertilization and percentage of hatchling observed and recorded was (77.12 % and 68.25 %) respectively (table no 2 and 4 figure 1 and 4)

Labeo rohita:

Total 54 females of *Labeo rohita* treated with ovaprim the effective dose was found to be 0.2- 0.3ml/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 (88.11- 97.94%) recorded and percentage of hatchling recorded was (82.93-96.15 %) when treated with ovaprim. Overall percentage of fertilization and percentage of hatchling observed and recorded was (94.06%-91.36%) respectively (table 1 and 3 figure 2 and 5)

Similarly total 38 females of *Labeo rohita* were injected with pituitary extract twice in twodifferent doses to female. The first dose given was 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 started after 6 hrs of second dose. The percentage of fertilization was (68.8-85%) and percentage of hatchling (62.20-75.73%) was recorded whentreated with pituitary extract. Overall percentage of fertilization and

percentage of hatchling observed and recorded was (94.06%) and (91.36 %) respectively (table no 2 and 4 figure 2 and 5).

Cirrhinus mrigala:

Total 51 females of *Cirrhinus mrigala* treated with ovaprim the effective dose wasfound to be 0.2-0.3 ml/kg body weight of male and female respectively. They were inducedspawning after 10-12 hrs of injection. The percentage of fertilization was (87.88 –95.94%) and percentage of hatchling (74.70 - 96.45%) when treated with ovaprimpercentage of hatchling observed and recorded was (92.89 %) and (88.34%) respectively (table 1 and 3 figure 3 and 6)

Similarly, total 41 females of *Cirrhinus mrigala* were injected with pituitary extract twice in two different doses to female. The first dose given was 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 started after6 hrs of second dose.

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

Discussion:

It has been reported, overall fertilization percentage (91.01%) and overall hatchling percentage (67.50%) average number of egg kg (67670), average number of fertilized egg kg (61620), average number of hatchling kg (41584) in *Catla catla* [19 and 33]

The rate of fertilization and hatchling percentage are generally higher with ovaprim as compared to pituitary extract [20 and 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 shows that the results of fertilization and hatchling percentage 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 ovarprim. In terms of fertilization and hatchling ovarprim yielded better result [26 and 33].

The highest percentage of fertilization (95-98%) was observed in ovaprim treatment *C. striatus* and *C. mrigala* injected with ovaprim 90% fertilization was observed by [27 and 28]

It has been noticed that whatever the earlier findings were their they are positive correlation with the findings of the present study. It is observed that the highest percentage of fertilization (87 %) and the highest percentage of hatchling (87.33%) at 27-28°c in *Labeo rohita* 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 with pituitary extract. Reduced handlings of brood fish due to single dose administrated to both the sexes at the same time due to decrease post spawning, mortality

of fish and increase spawning response in ovaprim treatment when compared to pituitary extract treatment.

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

Species	Month	No. of female treated	Total wt offe male (kg)	Avera geno. of eggs obtain ed	Dose of ovapri m	Avera geno. of fertiliz ed eggs	Total no. of hatchl ing	erageno. eggs Kg-1	Average no. fertilized eggs KgG1	Average no. Hatchling eggs KgG1	Averag e fertiliza tio nrate (%)	Avera ge Hatchl i rangrat e(%)
Catla catla	June 2020	5	17.0	16200 00	0. 4-0.6	15000 00	13500 00	140000	88235.2 9412	79411.76 471	92.592 59	90
	July 2020	4	12.0	14500 00	0.4 - 0.6	13700 00	12300 00	95294.1 1765	114166. 6667	102500	94.482 76	89.781 02
	July 2020	4	16.0	17600 00	0.4 - 0.6	16900 00	15600 00	120833. 3333	105625	97500	96.022 73	92.307 69
	Aug. 2020	4	19.0	23000 00	0.4 - 0.6	21160 00	18900 00	110000	111368. 4211	99473.68 421	92	89.319 47
	Aug. 2020	5	20.5	20000 00	0.4 - 0.6	19000 00	17900 00	121052. 6316	92682.9 2683	87317.07 317	95	94.210 53
	June 2021	5	18.0	17000 00	0.4 - 0.6	15950 00	14400 00	97560.9 7561	88611.1 1111	80000	93.823 53	90.282 13
	July 2021	5	17.5	20150 00	0.4 - 0.6	19140 00	18000 00	94444.4 4444	109371. 4286	102857.1 429	94.987 59	94.043 89
	July 2021	5	20.0	24500 00	0.4 - 0.6	22800 00	21700 00	115142. 8571	114000	108500	93.061 22	95.175 44
	Aug. 2021	5	19.5	22000 00	0.4 - 0.6	21120 00	19640 00	122500	108307. 6923	100717.9 487	96	92.992 42
	Aug. 2021	5	20.5	22100 00	0.4 - 0.6	20800 00	19300 00	112820. 5128	101463. 4146	94146.34 146	94.117 65	92.788 46
Labeo rohita	June 2020	7	11.0	28600 00	0.4 - 0.6	25200 00	20900 00	260000	229090. 9091	190000	88.111 89	82.936 51
	July 2020	5	9.5	23750 00	0.4 - 0.6	22100 00	21200 00	250000	232631. 5789	223157.8 947	93.052 63	95.927 6
	July 2020	5	10.5	19250 00	0.4 - 0.6	18500 00	17100 00	183333. 3333	176190. 4762	162857.1 429	96.103 9	92.432 43
	Aug. 2020	5	9.0	25200 00	0.4 - 0.6	23900 00	21100 00	280000	265555. 5556	234444.4 444	94.841 27	88.284 52
	Aug. 2020	5	11.5	32800 00	0.4 - 0.6	31200 00	30000 00	285217. 3913	271304. 3478	260869.5 652	95.121 95	96.153 85

	June 2021	6	12.0s	3040000	0.4 - 0.6	2790000	2500000	253333.3333	232500	208333.3333	91.77632	89.60573
	July 2021	5	9.5	3050000	0.4 - 0.6	2910000	2730000	321052.6316	306315.7895	287368.4211	95.40984	93.81443
	July 2021	5	10.0	2500000	0.4 - 0.6	2380000	2150000	250000	238000	215000	95.2	90.33613
	Aug. 2021	5	9.0	2850000	0.4 - 0.6	2680000	2390000	316666.6667	297777.7778	265555.5556	94.03509	89.1791
	Aug. 2021	6	14.5	3900000	0.4 - 0.6	3820000	3630000	268965.5172	263448.2759	250344.8276	97.94872	95.02618
Cirrhinus mrigala	June 2020	7	13.0	1820000	0.4 - 0.6	1700000	1270000	140000	130769.2308	97692.30769	93.40659	74.70588
	July 2020	4	8.5	1445000	0.4 - 0.6	1270000	1225000	170000	149411.7647	144117.6471	87.88927	96.45669
	July 2020	5	10.5	1735000	0.4 - 0.6	1561000	1370000	165238.0952	148666.6667	130476.1905	89.97118	87.76425
	Aug. 2020	4	7.5	1300000	0.4 - 0.6	1235000	1100000	173333.3333	164666.6667	146666.6667	95	89.06883
	Aug. 2020	5	11.5	2090000	0.4 - 0.6	2000000	1800000	181739.1304	173913.0435	156521.7391	95.69378	90.0
	June 2021	6	10.5	1520000	0.4 - 0.6	1370000	1150000	144761.9048	130476.1905	109523.8095	90.13158	83.94161
	July 2021	5	9.5	1500000	0.4 - 0.6	1390000	1225000	157894.7368	146315.7895	128947.3684	92.66667	88.1295
	July 2021	5	11.5	1725000	0.4 - 0.6	1655000	1530000	150000	143913.0435	133043.4783	95.94203	92.44713
	Aug. 2021	5	9.0	1490000	0.4 - 0.6	1400000	1190000	165555.5556	155555.5556	132222.2222	93.95973	85
	Aug. 2021	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 ---------- I st	II nd	Average no. of eggs	Total no. of hatchling	Average no. eggs KgG^{1}	Average no. fertilized eggs KgG^{1}	Average no. Hatchling eggs KgG^{1}	Average fertilization rate (%)	Average Hatchli rang (%)
Catla Catla	June 2020	5	17.5	1300000	0.2-0.4	0.6-0.8	970000	630000	74285.7143	55428.57143	36000	74.61	64.94
	July 2020	4	16.5	1300000	0.2-0.4	0.6-0.8	1000000	690000	78787.8788	60606.06061	41818.18	76.92	69
	July 2020	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. 2020	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. 2020	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 2021	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 2021	2	7.0	535000	0.2-0.4	0.6-0.8	420000	300000	76428.5714	60000	42857.14286	78.50	71.42
	July 2021	4	13.0	900000	0.2-0.4	0.6-0.8	720000	510000	69230.7692	55384.61538	39230.76923	80	70.83
	Aug. 2021	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. 2021	3	12.0	850000	0.2-0.4	0.6-0.8	660000	450000	70833.3333	55000	37500	77.64	68.18
Labeo Rohita	June 2020	5	12.0	1750000	0.2-0.4	0.6-0.8	1350000	950000	145833.333	112500	79166.66667	77.14	70.37
	July 2020	4	10.5	2500000	0.2-0.4	0.6-0.8	2000000	1450000	238095.238	190476.1905	138095.2381	80	72.5
	July 2020	5	10.0	1700000	0.2-0.4	0.6-0.8	1390000	990000	170000	139000	99000	81.76	71.22
	Aug. 2020	3	8.0	1300000	0.2-0.4	0.6-0.8	1030000	730000	162500	128750	91250	79.23	70.87
	Aug. 2020	5	10.5	1600000	0.2-0.4	0.6-0.8	1360000	1030000	152380.952	129523.8095	98095.2381	85	75.73
	June 2021	3	7.5	1150000	0.2-0.4	0.6-0.8	900000	600000	153333.333	120000	80000	78.26	66.66
	July 2021	3	8.0	1250000	0.2-0.4	0.6-0.8	860000	535000	156250	107500	66875	68.8	62.20
	July 2021	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. 2021	3	6.5	1000000	0.2-0.4	0.6-0.8	800000	510000	153846.154	123076.9231	78461.53846	80	63.75
	Aug. 2021	3	8.0	980000	0.2-0.4	0.6-0.8	770000	530000	122500	96250	66250	78.57	68.83
Cirrhinus mrigla	June 2020	5	12.0	940000	0.2-0.4	0.6-0.8	500000	300000	78333.3333	41666.66667	25000	53.19	60
	July 2020	5	10.5	790000	0.2-0.4	0.6-0.8	630000	450000	75238.0952	60000	42857.14286	79.74	71.42
	July 2020	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. 2020	3	5.5	450000	0.2-0.4	0.6-0.8	360000	270000	81818.1818	65454.54545	49090.90909	80	75
	Aug. 2020	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 2021	3	6.0	550000	0.2-0.4	0.6-0.8	470000	360000	91666.6667	78333.33333	60000	85.45	76.59
	July 2021	4	8.0	730000	0.2-0.4	0.6-0.8	560000	380000	91250	70000	47500	76.712	67.85
	July 2021	4	9.0	560000	0.2-0.4	0.6-0.8	450000	340000	62222.2222	50000	37777.77778	80.35	75.55
	Aug. 2021	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. 2021	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 treatedobtained	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 %
Catla catla	47	180	19705000	18557000	17124000	112964.88	103383.19	95242.39	94.20	92.05
LabeoRohita	54	106.5	28300000	26670000	24430000	266856.88	251281.47	229793.11	94.06	91.36
Cirrhinus mrigla	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.

	Number of	Total wt					Average no.	Average no.		
	female treated	of female (kg)	Total no.	Total no.	Total no.	Average no.	fertilized	Hatchling	Overall	Overall
Species	obtained	eggs	of eggs	of fertilized	of hatchling	eggs KgG^{1}	eggs KgG^{1}	eggs KgG^{1}	fertilization %	Hatchling %
Catla catla	37	137	10375000	8050000	5560000	75636	75636.33	39915.78	77.12	68.25
LabeoRohita	38	89.5	14510000	11570000	8105000	160532	160532.72	88895.83	79.07	69.64
Cirrhinus mrigla	41	87.5	7120000	5530000	4050000	83031	65360	48243.74	78.59	73.16

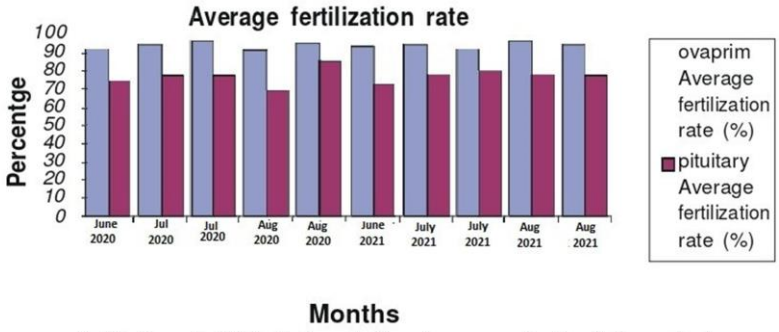

Fig. 1: Shows average fertilization rate (%) in *Catla catla* Ovaprim compared with pituitary extract

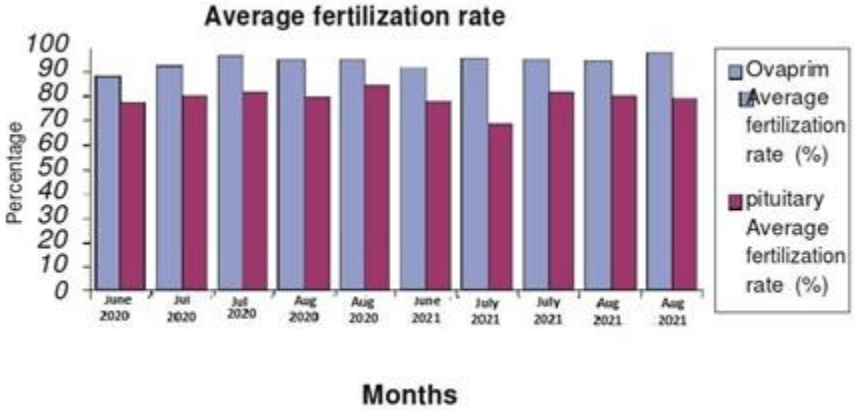

Fig. 2: Shows average fertilization rate (%) Ovaprim compared with pituitary extract in *Labeo rohita*

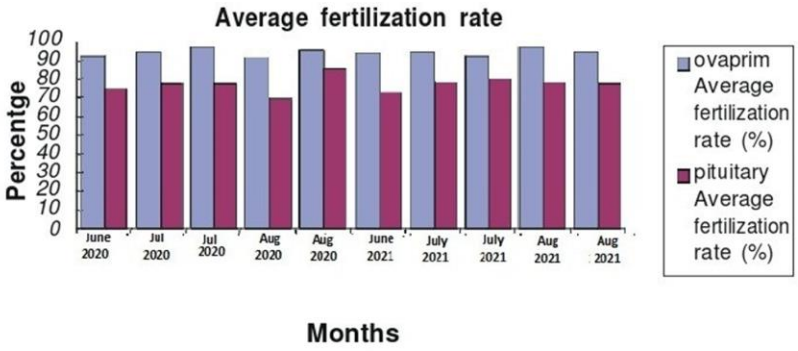

Fig. 4: Shows average hatchling rate (%). Ovaprim compared with pituitary extract in *Catla catla.*

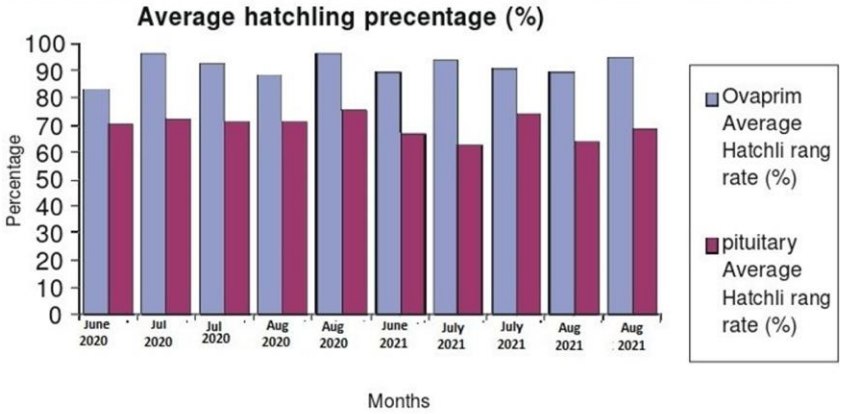

Fig. 5: Shows average hatchling rate (%)Ovaprim compared with pituitary extract in *Labeo rohita.*

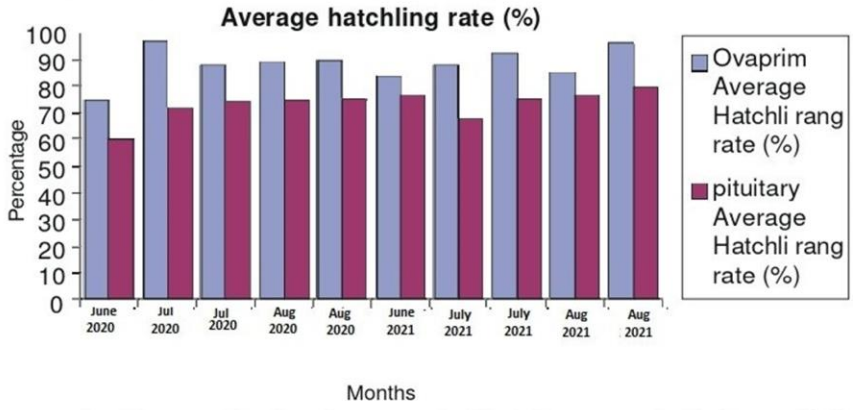

Fig. 6: Shows average hatchling rate (%) . Ovaprim compared with pituitary extract in *Cirrhinus mribala.*