

# Induced Spawning in *Pangasianodon hypophthalmus* and Hatching of Eggs in Three Different Types of Hatcheries at Raipur (Chhattisgarh for Mass Seed Production)

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## Introduction

*Pangasianodon hypophthalmus*, commonly known as striped (sutchi, iridescent shark) catfish, fetches high price in markets. Culture of this species is growing day-by-day in Bangladesh (Rahman *et al.*, 2006; Ahmed and Hasan, 2007; Ahmed *et al.*, 2013), Indonesia (Griffith *et al.*, 2010), India (Lakra and Singh, 2010; Singh and Lakra, 2012; Kumar *et al.*, 2013) and Vietnam (Phan *et al.*, 2009; Bui *et al.*, 2010). Vietnam is the top producer and exporter of *P. hypophthalmus* (Phan *et al.*, 2009; Bui *et al.*, 2010). Contribution of the Indian major carps in Indian aquaculture is more as compared to those of catfishes and in Andhra Pradesh itself, major carps contribute about 85% of the total freshwater fish production while catfishes and murrels show the next to them (Laxmappa, 2004). *P. hypophthalmus* is native of river Mekong Basin and Chao Phraya river in Thailand, Cambodia and Vietnam. It has been introduced in Singapore, Philippines, Taiwan, Malaysia, China, Myanmar, Bangladesh, Nepal and India. In India, it was brought in West Bengal through Bangladesh during 1997 (Mukai, 2011). Initially, its culture was carried out in Andhra Pradesh and West Bengal in private sector but the Government of India permitted aquaculture of *P. hypophthalmus* in 2010-11. Young ones of the species are bottom feeder and carnivore while the fingerlings feed on snail, worm, insects, gastropods etc. This species attain maturity at the end of third year while male mature in two years (Phuong and Oanh, 2009; Griffith *et al.*, 2010; Vidthayanon and Hogan, 2013; Anon, 2014).

*P. hypophthalmus* is a promising candidate species for freshwater catfish culture (young ones also possess ornamental values) and has captured all the markets of India in shorter period (Lakra and Singh, 2010; Singh and Lakra, 2012). There exist reports that this species is being sold in more than 100 countries, mainly in European Union (EU), Russia, South-east Asia and USA in the form of white fillets (Nguyen, 2007; Phuong and Oanh, 2009; Phan *et al.*, 2009). For culture of this species in West Bengal, the seed were initially procured through Bangladesh. Though the species has been induced bred in West Bengal, Andhra Pradesh and Chhattisgarh and some hatcheries established in these states, the survival of offspring has been very poor. Sutchi catfish is highly fecund fish, seasonal spawner and breeds once in a year in flooded rivers. Recently, *P. hypophthalmus* has been bred successfully in Mekong Delta region of Vietnam by using high doses of human chorionic gonadotropin (HCG) (Bui *et al.*, 2010). Success has also been achieved in induced breeding of *P. hypophthalmus* employing GnRH-based drug and dopamine antagonist (ovaprim) at Raipur (Chaturvedi *et al.*, 2014). An attempt has been made to induce breeding in the sutchi catfish by exogenous pituitary gland extract (PGE) administration and larval rearing in different types of hatcheries for mass seed production under agro-climatic conditions of Raipur (Chhattisgarh). Since physico-chemical conditions of water like pH, dissolved oxygen, temperature, alkalinity as well as metabolites play important role in fish breeding (Dwivedi and Ravindranathan, 1982), these parameters were monitored regularly and kept optimal while





**Fig. 1:** Circular hatchery of *P. hypothalamus* at State Fisheries Department, Raipur.



**Fig. 2:** Circular hatchery of *P. hypothalamus* with hatching pool at State Fisheries Department, Raipur.



**Fig. 3:** Vertical jar hatchery of *P. hypothalamus*.



**Fig. 4:** Vertical jar hatchery of *P. hypothalamus* owned by private fish farmer at Raipur.



**Fig. 5:** Thailand model hatchery of *P. hypothalamus* at Raipur.



**Fig. 6:** Detailed view of Thailand model hatchery of *P. hypothalamus* at Raipur.

undertaking induced the breeding experiments.

## Materials and Methods

Breeding and hatching experiments were carried out at State Fisheries Department and private Fish Farms at Raipur (Chhattisgarh). Male and female brooders of *P. hypophthalmus* (Family Pangasiidae) were reared at M/S Hemant Chaudrakar Fish Farm at Dhamtari. At this farm, vertical glass jar hatchery with 15 cemented vertical jars was developed in the year 2010-11. Physico-chemical parameters of the water during the breeding experiments were analyzed as per APHA (1998). For induced breeding experiments, mature and gravid brooders of both the sexes of age group 3 (+) years were collected and induced bred by varying doses of pituitary gland extract (PGE) depending upon the physiological status of fishes. Male brooders were also given PGE at the time of second injection to females. Injected brooders were kept in cemented breeding tanks of size (3 x 2 x 1 m) with flowing water. The stripping was done in the early morning (6 am) after 10-12 hours of the final injection as female were ready for spawning. After fertilization, separated eggs were transferred for incubation to the three type of hatcheries - (i) Circular Hatchery (Fig. 1, 2), (ii) Vertical Jar Hatchery (Fig. 3, 4) and (iii) Thailand Model Hatchery (Fig. 5, 6).

## Results

Physico-chemical parameters of the water during the breeding experiments were found to be within the optimum range (Table 1). Details of the breeding trials conducted on *P. hypophthalmus* at Raipur (Chhattisgarh) have been summarized in (Table 2). In the present experiment, 15 females and 15 males (15 sets, 1:1 sex ratio) were selected and induced bred by varying doses of pituitary gland extract (PGE) depending upon the physiological status of the brooders (after first injection, the second injection was administered after 6 hours). In this study, male brooder were also given pituitary gland extract at the time of second injection to females (Table 2). The eggs of *P. hypophthalmus* were very small (diameter 1.4-1.8 mm), adhesive in nature while fertilized eggs were light creamy or brown in colour. For fertilization of one million eggs

of *P. hypophthalmus*, one ml milt was used. After fertilization, three type of solutions such as cow milk, multani soil (mitti) and black soil were used for removal of stickiness of eggs. Separated eggs were transferred to the three type of hatcheries - (i) Circular Hatchery (Fig. 1, 2), (ii) Vertical Jar Hatchery (Fig. 3, 4) and (iii) Thailand Model Hatchery (Fig. 5, 6) for incubation. Fertilization of eggs varied from 30-80% and survival of the hatchlings varied from 30-60% in all the three hatching systems. After incubation of fertilized eggs from vertical jar hatchery 17,30,400 hatchlings, in circular hatchery 14,08,000 hatchlings while in Thailand model hatchery, only 3,17,500 hatchlings were obtained. The hatching percentage were observed 60% in vertical jar hatchery, 50% in circular hatchery and 30% in Thailand model hatchery. After 2 days, yolk absorption was observed and from the three types of hatcheries - 9,88,740 fry were realised from vertical jar hatchery, 7,40,000 from circular hatchery and 65,550 from Thailand model hatchery. After rearing the fry in nursery ponds for 25-30 days, 5,93,244 fingerlings from Krundh-Liey Fish Farm, 4,22,400 fingerlings from State Fisheries Farm, Raipur and 65,550 from Deepak Mandal Fish Farm (Thailand model hatchery) (total 10,81,144) were obtained.

## Discussion

Induced breeding of the Indian major carps has been achieved successfully by administration of pituitary gland extract (PGE) and different preparation of synthetic GnRH-based drugs and dopamine antagonists (Chaudhuri and Alikunhi, 1957; Chaudhuri, 1960; Chaudhuri *et al.*, 1966; Varghese *et al.*, 1975; Dwivedi and Ravindranathhan 1982; Chaudhuri and Singh, 1984; Peter *et al.*, 1988, 1993; Nandeeshha *et al.*, 1989, 1990; Lakra *et al.*, 1996; Mahanta *et al.*, 1998; Pandey *et al.*, 1998, 2001, 2002a, b, 2009; Singh *et al.*, 2000). Even catfishes have also been induced bred through the similar preparations/drugs (Ramaswamy and Sundararaj, 1956, 1957; Khan, 1972; Devaraj *et al.*, 1972; Khan and Mukhopadhyay, 1975; Pathak *et al.*, 1982; Zonneveld *et al.*, 1988; Kohli, 1989, Kohli and Vidhayarathi, 1990; Rao and Janakiram, 1991; Alok *et al.*, 1993, 1995; Tharakan and Joy, 1996; Goswami and Sarma, 1997; Kanungo *et al.*, 1999; Nayak *et al.*,



**Table 1:** Physico-chemical parameters during the breeding experiments at Raipur.

Sl. No.	Parameters	I 24.8.2014	II 25.8.2014	III 26.8.2014	IV 27.8.2014	V 28.8.2014	Remarks
1	Dissolved oxygen (mg/l)	4.8	4.8	5.2	4.8	5.0	Hatchery water
2	Free carbon dioxide (mg/l)	--	--	--	--	--	--
3	Iron (mg/l)	0.2	0.1	0.2	0.1	0.2	
4	Water temperature (Hatchery)	27.4 oC	27.6 oC	28.5 oC	28.4 oC	28.6 oC	Hatchery water
5	pH	7.4	7.5	7.8	7.5	7.4	
6	Salinity (ppt)	--	--	--	--	--	--
7	Total alkalinity (mg/l)	111	114	121	120	112	
8	Weather temperature (°C)	34.6	34.2	34.2	34.0	34.6	
9	Weather	Sunny	Sunny	Sunny	Sunny	Sunny	
10	Fertilization % (after removal of stickiness)	70%	60%	70%	80%	80%	After stripping and washing of eggs

2000; 2001; Singh *et al.*, 2002; Pandey and Koteeswaran, 2004; Sahoo *et al.*, 2005; Mishra *et al.*, 2011; Yadav *et al.*, 2011; Taslim and Ahemd, 2012; Chaturvedi *et al.*, 2012a, b, c, 2013). There exist report that the striped catfish has been bred successfully in Mekong Delta region of Vietnam by using high doses of human chorionic gonadotropin (HCG) (Bui *et al.*, 2010). We successfully induced bred *P. hypothalamus* through ovaprim administration under agro-climatic conditions of Raipur (Chhattisgarh) with better survival of fry and fingerlings (Table 2).

There exists a lot of scope for freshwater catfish farming in India for diversification of aquaculture and sustainable production (Dehadrai, 1978; Tripathi, 1990; Thakur, 1991; Nayak *et al.*, 2000). Since the culture of *P. hypothalamus* is more profitable among the catfishes, there exist more demand of this species for aquaculture in India and tropical regions of the America (Rahman *et al.*,

2006; Lakra and Singh, 2010; Mukai, 2011; Singh and Lakra, 2012; Hekimoglu *et al.*, 2014; McGee, 2015). Vietnam has shown the record production (1.0-1.5 million tonne per annum) of *P. hypothalamus* (Nguyen, 2007; Phuong and Onah, 2009; Phan *et al.*, 2009). Though the striped catfish is widely cultured in China, Vietnam, Thailand, Taiwan, Philippines, Cambodia, Indonesia, Lao People's Democratic Republic, Bangladesh, Nepal and India (Griffith *et al.*, 2010), this species has been declared Endangered in Vietnam due to over-exploitation, habitat degradation, changes in flow and water quality as well as over-harvesting of eggs, fry and juveniles for aquarium trade (Vidhayanon and Hogan, 2013; Anon, 2014). The success has been achieved earlier in induced spawning and seed production (10,50,000 fry and 6,30,000 fingerlings) of *P. hypothalamus* through ovaprim administration and hatchery development in Raipur (Chhattisgarh) (Chaturvedi *et al.*, 2014) for seed



**Table 2:** Induced breeding and larval rearing of *P. hypothalamus* in the three different model hatcheries at Raipur.

Sl. No.	Date	Weight of fish (kg)		Pituitary dose (mg/kg)		Injection time (hours)	Stripping time (hours)	Total eggs (in lakh)	Total number of good eggs (in lakh)	Fertilization (%)	Hatchlings (in lakh)	Percentage (%)	Fry	Fingerlings
		Male	Female	Male	Female									
<b>Circular Hatchery</b>														
1	24.8.2014	3.4	4.4	40	15, 20,	17.00	0.03	4.0	3.20	80	2,56	50	1,26,000	
2	25.8.2014	3.0	5.0	50	15, 25	17.00	0.03	6.0	4.80	80	3.84	50	1,92,000	
3	26.8.2014	4.2	6.5	64	20, 32	17.00	0.04	6.0	4.20	70	2.94	50	1,47,000	
4	27.8.2014	4.5	6.0	60	22, 30	17.00	0.04	6.0	4.20	70	2.94	50	1,57,000	
5	28.8.2010	4.0	5.50	40	20, 25	17.00	0.03	5.0	3.00	60	1.80	50	90,000	
								27.0	19.4		14,080		7,04,000	4,22,400
<b>Vertical Jar Hatchery</b>														
6	26.8.2014	2.9	3.5	30	10, 15	16.00	0.02	3.2	3.10	80	2.790	60	1,67,400	
7	27.8.2014	3.0	4.9	40	15, 20	16.00	0.02	4.2	3.36	80	3.024	60	1,81,440	
8	28.8.2014	3.6	4.7	50	18, 25	16.00	0.01	5.0	4.80	80	3.840	60	2,30,400	
9	28.8.2014	3.0	5.2	50	17, 25	16.00	0.02	4.4	4.30	80	3.870	50	1,93,500	
10	30.8.2010	3.0	5.2	50	15, 25	16.00	0.02	5.0	4.00	80	3.600	60	2,16,000	
								21.8	19.56		17,304		9,88,740	5,93,244
<b>Thailand Model Hatchery</b>														
11	09.08.2014	3.5	3.8	40	20, 25	8.00	9.00	2.0	1.00	50	0.50	30	15,000	
12	10.08.2014	2.9	4.2	50	18, 30	7.30	8.30	4.0	1.20	30	0.60	30	18,000	
13	11.08.2014	3.2	5.4	60	18, 40	8.30	9.30	3.5	1.05	30	0.525	25	15,750	
14	12.08.2014	3.8	5.4	60	18, 40	8.30	9.30	3.0	1.20	40	0.60	30	18,000	
15	13.08.2014	3.8	6.0	70	25, 40	9.00	10.00	4.8	1.90	40	0.95	30	28,500	
								17.3	6.35		3,175		95,250	65,550
<b>Total (fingerling production)</b>														<b>10,81,194</b>

**Table 3:** Description of three hatcheries used for hatching of eggs of *P. hypothalamus*.

Sl. No.	Parameters	Circular hatchery	Vertical Jar Hatchery	Thailand Hatchery	Specifications
1	Shape	Circular	Vertical Jar	Circular with Hatching trays	Eggs handling trays (45°) (3x1x0')
2	Inlet	Horizontal base	Vertical bottom	Horizontal	Ground water
3	Water flow	120 l/m	4-6 l/m	6-10 l/m	Ground water
4	Egg loading	14, 08,000	17,30,400	3,17,500	Ground water
5	Hatching (%)	60	50	30	Ground water
6	Spawn	7,040,000	9,88,740	65,500	Ground water
7	Water depth	3.0'	3.5'	3.0	Ground water

production of this species for conservation aquaculture (True *et al.*, 1996; Anders, 1998) which will reduce the pressure on collection of fry and juveniles from the wild natural habitats (Nguyen, 2009). In the present study, after rearing the fry in nursery ponds for 25-30 days, 5,93,244 fingerlings from Krundh-Liey Fish Farm, 4,22,400 fingerlings

from State Fisheries Farm, Raipur and 65,550 from Deepak Mandal Fish Farm (Thailand model hatchery) (total 10,81,144) were obtained paving the way for mass seed production of the commercially important catfish under agro-climatic conditions of Raipur (Chhattisgarh).

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