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INDUCED BREEDING OF STINGING CATFISH (*Heteropneustes fossilis*) IN BANGLADESH

Abstract

The stinging catfsh *Heteropneustes fossilis* commonly called shing is very popular and high priced and preferred by consumers in South and South-East Asia countries. Catfsh farmers are unable to practice shing culture due to lack of seeds availability in all over Bangladesh. Induced breeding of stinging catfsh (*H. fossilis*) of Bangladesh by various hormonal analogues is reviewed based on published information. Pituitary gland extract, Human chorionic gonadotropin (HCG) and synthetic hormones viz., flash, ovaprim and ovatide are successfully being tested for the induced breeding of this fish by various researchers in Bangladesh, with varying degree of success. Male and female brooders were identified based on secondary sexual characters-whereas the males have genital papilla elongated and pointed with oozing milt by applying slight pressure on belly while females have round and blunt genital opening. Females and males were given intramuscular injection of different hormones at different doses like Pituitary extract, ovaprim, HCG and ovatide. This review has conducted to acquire experience on induced breeding of shing, their breeding performance, ovulation rate, fertilization rate and hatching rate. Use of only single hormone for both for male and female at different amount doses and use of two different hormones for male and female at different amount doses are both practice for shing breeding. In this review, induced with hormone PG (Male 10 mg/kg and female 70 mg/kg) found the highest fertilization rate (95%) and hatching rate (93%). On the other hand, the male and female fishes were injected with synthetic hormone flash (Male-0.17 ml/kg and female-0.42 ml/kg) showed lowest fertilization rate (63.56%) and hatching rate (54.47%). Even though natural spawning is the favorite method for breeding of cultivated fresh water fishes, induced breeding is necessary to control timing and synchrony of egg production.

Key words: Stinging catfsh *Heteropneustes fossilis*, Pituitary gland, HCG, ovaprim, ovatide, ovulation rate, fertilization rate, hatching rate.

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Chapter 1

INTRODUCTION

The stinging catfish *Heteropneutes fossilis*(Bloch, 1974) belongs to the family Heteropneustidaeis a commercially important fish species inBangladesh. This is primarily a fish of ponds, ditches,beels, swamps and marshes, but sometimes found inmuddy rivers (Jha and Rayamajhi, 2010; Froese andPauly, 2012). The air-breathing apparatus of stingingcatfish enables it to exist in almost any kind of water.It is also able to tolerate slightly brackish water.Commonly, during the dry season *H. fossilis* lives insemiliquid and semi-dry mud, and even when the muddries up they take their bodies to the bottom offissures and crevices formed by the cracking mud. *H.fossilis* can respire aerially by gulping in air at variousintervals when the oxygen content of water is low(Munshi, 1993). Whilst it is heavily utilized for foodand for medicine in many parts of its range, and itmay be threatened by over exploitation and habitatloss and degradation (especially from pollution and dams) and subsequently, it is considered least concernat present (IUCN, 2012). Because of its fast growth,tolerance to high stocking densities, high marketvalue, ability to survive in oxygen-low waters, lowfat, high protein and iron content and medicinalvalues, *H. fossilis* is considered as an ideal fishspecies for aquaculture (Dehadrai *et al.*, 1985; Alok *etal.*, 1993; Vijayakumar *et al.*, 1998; Haniffa andSridhar, 2002; Froese and Pauly, 2012). Also,aquaculture of this species will be helpful not only inincreasing the overall production but also in theconservation of this important fish species.

Aquaculture of the stinging catfish inBangladesh is widely spreading. However, constantsupply of good quality fingerlings is vital for theculture of any fish species including *H. fossilis*.Although, major sources of fry and fingerlings foraquaculture were mainly the capture fishery due to thelimited capacity of the then existing hatchery facilitiesin the past,

nonetheless, induced breeding techniqueshave continually improving in Bangladesh. Subsequently, at present, hatchery producedfry/fingerlings become the major sources of seed forthe aquaculture industry in the country. While theproduction of fish seed from hatchery sources hasincreased dramatically, the quality has not improvedowing to poor hatchery management practicesresulting deleterious effects such as negativeselection, inbreeding depression, indiscriminateinterspecific hybridization etc.

Although a few studies on the induced breedingof *H. fossilis* are available including effects of carppituitary gland extract, human chorionic gonadotropinand synthetic hormone (ovaprim) doses on inducedbreeding, maturation and ovulation of *H. fossilis*(Alok *et al.*, 1993; Begum *et al.*, 2001; Nayak *et al.*,2001; Haniffa and Sridhar, 2002), however, detailed studies on the inducedbreeding of *H. fossilis* are clearly missing inBangladesh.

Considering the above facts the present study was undertaken to fulfill the following objectives:

1. To review the *Heteropneustes fossilis* fry production by different hormone application
2. To review the effect of different hormones at different breeding parameters of *H. fossilis*

Chapter 2

MATERIALS AND METHODS

This seminar paper is exclusively a review paper. Therefore, all the information were collected from secondary sources with a view to prepare this paper. Various relevant books and journals, which were available in the library of Bangabandhu Sheikh Mujibur Rahman Agricultural University (BSMRAU), were used for the preparation of this paper. For collecting recent information internet browsing was also be practiced. Good suggestions, valuable information and kind consideration from my honorable Major Professor, course instructors and other resources personnel were taken to enrich this paper. After collecting necessary information, it has compiled and arranged chronologically for better understanding and clarification.

Chapter 3

REVIEW OF LITERATURE

Breeding behavior of *Heteropneustes fossilis*

Ali, F. *et al*., (2014) studied breeding behavior of *H. fossilis.* The breeding behavior was observed continuously after the injected shing fishes released into the breeding tank. After 4 hours of injection the activities and movement of male fish was increased. The male started to move around the female and chase her. It started to nudge with its snout at the ventral region of the female fish. This activity was going for a long period. The activities of female were also increased. It started to move and stay at middle of the water column. After that suddenly the male quickly came to the female and the male nudge with its snout at the ventral region of the female. The female makes its body "U" shaped and holds the head of the male inside its "U' shaped structure and on the bending condition the male brought the female at the surface of the water. Pressure was created on the ventral region of the female fish by the male shing with its snout. In this time the female released eggs at the surface of the water column and simultaneously the male ejaculated sperm. Then the eggs slowly fall down to the bottom of the tank. The fertilized eggs were black and greenish blue in colour and they settle on the bottom.

Induced breeding

Fish reproduction is a periodic phenomenon and is controlled by environmental (exogenous) as well as internal (endogenous) regulatory mechanisms. The acts of breeding occur under optimal environmental conditions that are favorable to the survival of the young ones. Environmental stimuli are detected by sensory organs, relayed to brain, that triggers endogenous mechanism into action. Endogenous mechanism is mediated through cascade of

various neurotransmitters and hormones secreted by tissues of brain-hypothalamus-pituitary-gonadal axis. The secretion of above axis is regulated through positive and negative feedback mechanisms involving specifically sensitive hormone receptors (Somashekar*et al.,* 2016). In fish, similar to all higher animals, hormones play a critical role in the reproductive process. The primary tissues involved in this hormonal cascade are the hypothalamus, pituitary gland, and gonads.

History of induced breeding in *H.fossilis*

The first success of induced breeding in *H.fossilis* was achieved by Ramaswami and Sundararaj (1956) using homoplastic pituitary gland. The All India coordinated Research Project on Air-breathing Fish Culture recommended a dose of 80-120 mg/kg of female *H.fossilis*. Since then there is a growing interest in theseed production of this species for aquaculture (Alok*et al*., 1993; Vijaykumar*et al*., 1998; Haniffa*et al*., 2002). During the early days, carp pituitary extract has been selected for induced breeding in obligatory air-breathing fishes. The ever increasing demand of donour pituitary and the cumbersome process obliged experts to test alternative hormones such as human chorionic gonadotropin (HCG; Haniffa *et al*., 2002), luteinizing hormone releasing hormone (Nayak*et al*., 2000), α 17 hydroxyl progesterone and ovaprim (Haniffa *et al*., 2002).

Nayak *et al*., (2000) recommended stocking of male and female brooders in small ponds (100-200m^2) at a stocking density of 10-20 fish/m^3. According to them the maintenance of brood stock is also possible under laboratory conditions by rearing the fish in cemented cisterns. Saha *et al*., (1998) stocked *H.fossilis* brooders in stocking ponds of 60 m^2 area at a density of 20000 fish/ha.

Inducing agents used for induce breeding ofstinging catfish

Commercially available dehydrated carp pituitary gland extracts (PGE) and synthetic hormone ovaprim, human chorionic gonadotropin (HCG),ovatide, gonadotropin releasing hormone (GnRH)at different doses and combinations have been applied on *Heteropneustes fossilis* (Ali F. *et al*., 2014).Pituitary gland (PG) and synthetic hormone ovaprimare most familiar and widely used among the farm owners all over the country.Table 1 depicted comparative study on induced breeding of cat fish *H.fossilis* by various synthetic hormones by various workers.

Figure 1.Inducing agents used for induced Breeding of *H.fossilis.***Source:Akter, 2011**

Table 1: Induced breeding in *H.fossilis* attempted by different researchers

Hormone	**Dose**	**Latency Period (hrs)**	**Reference**
ovaprim	0.6-0.8ml/kg	96.3	Nayak *et al*., 2001
Ovaprim	0.5ml/kg	92.33	Karl Marx and Chakrabarty, 2007
Ovatide	0.5ml/kg	96.0	
wova-FH	0.5ml/kg	87.33	
Pituitary	2mg	15	Rahman *et al*., 2013
Ovaprim	6ml/kg	10	
HCG	01-0.3	15	

Source: Haniffa *et al*.,2002

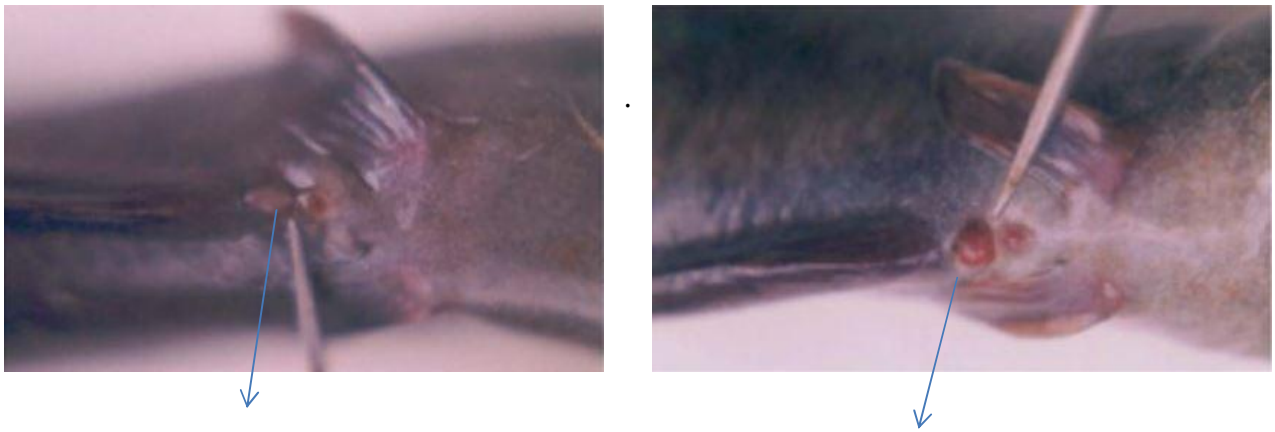
Brood maturityand Brood Selection study

Brood fishes were collected from the rearing ponds using a cast net in the morning between 8:00-9:00 am on the day of the breeding trials and immediately transferred to a circular tank in the hatchery. Only conspicuous, healthy and uninjured fishes were selected for induced breeding (Ali F. *et al*., 2014). The male and female fish were determined by eye estimation based on the criteria presented in Table 2. The males look lean with pale vent and a papilla like structure with a pointed tip (Figure 2a). In a mature female, the genital papilla remains in the form of a raised prominent structure, round and blunt with a slit like opening in the middle (Figure 2b).

Table 2: Criteria followed to select mature breeders of *H. fossilis*

Male	Female
1. Slim and streamlined body.	1. Abdomen is swollen and soft.
2. Genital papilla elongated and pointed.	2. Round and blunt genital opening.
3. Pressing on the belly, small amount of milt comes out.	3. Pressing on the belly, a few eggs comes out.
4. Normal vent.	4. Prominent reddish vent.

Source: Ali F. *et al*., 2014



(a)Genital papilla elongated & pointed of male(b) Round & blunt genital opening offemaleFigure2. Male and female fish identification.

Source: Haniffa *et al*., 2017

Conditioning of Brood fish

Brood fish were collected from the rearing ponds using a cast net in the morning between 8:00- 9:00 am on the day of the breeding trials and immediately transferred to circular tanks in respective hatcheries. The males and females were kept in separate tanks and continuous water flows were sustained at a rate of 10/min. Water quality parameters should be dissolved oxygen: 5.2-5.7 ppm; CO_2: 4.6-5.8 ppm; pH: 7.3-8.5; temperature: 27–30°C(Rahman *et* al., 2013).However, no supplementary feed were provided throughout the conditioning period.

Hormone administration

After preparation of hormone, brood fishes were caught carefully by net, and kept in sponge. The hormone was administered intra-muscularly near dorsal fin and above the lateral line with the 1 ml syringe (Figure 3). The amount of solution for each fish was determined before injection according to the body weight of the broods. After injection male and female were kept in hapa where they released eggs automatically after 8-12 hours depending on the treated doses (Ali M. *et al*., 2016). For dose optimization fertilization rate, hatching rate and survival rate were determined.

Figure 3. Intramuscular injection of hormone.

Source: Khanam, 2012

Breeding and Egg Transfer for Incubation

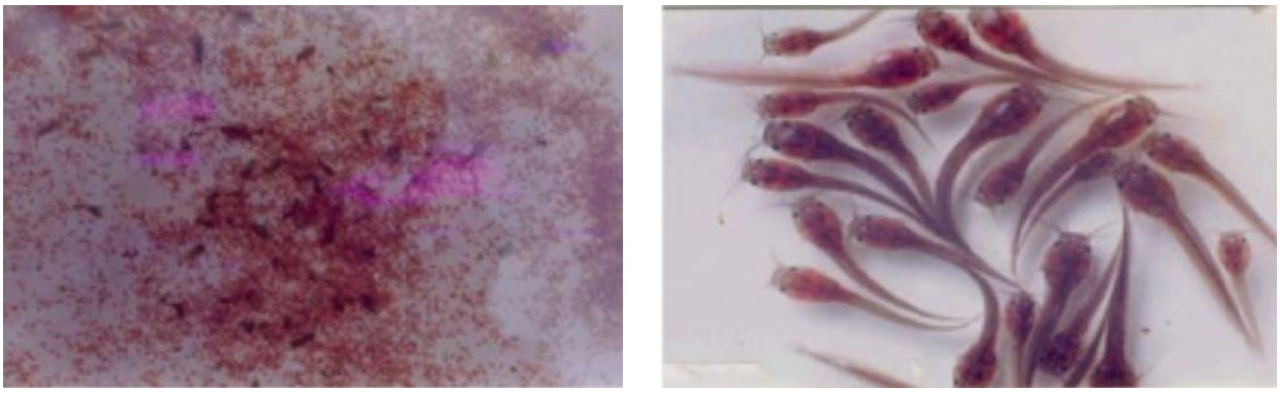
All the brooders were ovulated after a period of 10-15 hrs after injection.The brooders were then transferred from the holding tanks after the completion of ovulation (Ali F. *et al*., 2014). Whereas, the fertilized eggs were transferred into mini rectangular hatching trays with taking precaution to avoid damage and fungal/bacterial contamination during the eggcollection (Nayak*et al*., 2000).The number of eggs released into each tray was estimated using gravimetric methods adapted from Legender (1986) (Figure 4).

Figure4. Eggs of *H.fossilis*

Post–larval and fry rearing

Saha et al., (1998) transferred the four days old hatchlings of *H.fossilis* to polythene covered trays (30.48×60.96×15.24cm) until the larval period was completed without feeding. After completion of the larval period,the post-larvae were transferred in trays at 10-20 post-larvae/ tray (Figure 5a). The post-larvae were fed on powdered milk (100g), egg (one), boiled potato (100g) and raw fish muscle with or without skin (100g) in paste from at 10% body weight twice per day.Successful rearing of post-larvae up to the stage suitable for stocking in nursery ponds remains as the major challenge for the expansion of culture practice of *H.fossilis* at commercial level.Hence suitable feed is the basic requirement for the growth and survival of

fish larvae. Though most of the fish larvae relish best on planktonic fauna in the young age, they need nutritionally balanced food in bulk quantity at later stages of their life (Srivastava*et al*., 2012). Significant improvements in formulated diets for larval fish have occurred in regard to feed size, palatability and nutritive quality. Artemia are a widely used live feed for many fish larvae and can be a significant part of the cost of fry production.



(a)(b)

Figure 5. (a) Post larvae of *H.fossilis* (b) Fry of *H.fossilis*

Source: Haniffa *et al.*, 2017

Determination of ovulation, fertilization and hatching rate

Ovulation, fertilization and hatching rates were calculated using the following formula (Ali F. *et al*., 2014: Ali M. *et al*., 2016: Rahman *et al*., 2013):

$$\text{Ovulation rate (\%)} = \frac{\text{No. of fish ovulated}}{\text{Total no. of fish injected}} \times 100$$

To determine the fertilization rate 100 eggs was taken in a Petridis from hatching jar. Then the eggs were observed under a magnifying glass and fertilized eggs were counted. The fertilized eggs are not transparent as the hatching egg. Their color is slightly brownish. The fertilized eggs were easily separated from the unfertilized eggs by the presence of transparent shell with gray spot within the eggshell, while the unfertilized eggs were opaque. The fertilization was determined by the following formula:

$$\text{Fertilization rate (\%)} = \frac{\text{No. of fertilized eggs}}{\text{Total no. eggs (fertilized and unfertilized)}} \times 100$$

Hatching was completed after 22±2 hours of. To determine hatching rate 100 fertilized eggs were collected in a tray and the total numbers of the hatchlings were counted by visual observations. The hatching rate was determined using the following formula:

$$\text{Hatching rate (\%)} = \frac{\text{No. of eggs hatched}}{\text{Total no. of fertilized eggs}} \times 100$$

INDUCED BREEDINGof *H. fossilis*by USING DIFFERENT DOSE of HORMONE

Induce breeding of *H. fossilis* using different dose of synthetic hormone flash

Ali M. *et al.*, (2016)was studied induced breeding of *H. fossilis* (Bloch.). The study was consisted of three treatments (T1, T2 and T3).To observe the effective dose for induced breeding, the females were injected at the rate of 0.5 (T1), 0.45 (T2) and 0.42 (T3) ml Flash/kg body weight and correspondingly the males were administered a dose of 0.20 (T1), 0.18 (T2) and 0.17 (T3) ml Flash/kg body weight in all treatments.Latency period showed no variations with different dose but incubation periodshowed variations with different dose (Table 3).

Table 3: Showing details of induced breeding of Stinging Catfish, *H. fossilis* using different doses of synthetic hormone flash

Treatment	Doses of hormone	Latency period (hrs)	Incubation period (hrs)
T1	Male- 0.2 ml/kg Female- 0.5 ml/kg	12-14	19-20
T2	Male-0.18 ml/kg Female-0.45 ml/kg	12-14	20-22
T3	Male-0.17 ml/kg Female-0.42 ml/kg	12-14	22-24

Source: Ali M. *et al*., (2016)

Induce breeding of *H. fossilis* using different inducing agents at different doses

Rahman *et al*., (2013) worked on induced spawning in mature stinging catfish *H. fossilis* to spawn in spawning season by commercially available dehydrated carp pituitary gland extracts (PGE) and synthetic hormone ovaprim and HCG were used.Pituitary gland extract (PGE) was administered at 6 mg/kg body weight of females and 2 mg/kg body weight of males.In contrast,ovaprim was administered at 0.5 ml/kg and 0.1 ml/kg body weight of females and males, respectively and human chorionic gonadotropin (HCG) was injected at 1000 IU/kg body weight of both male and female fishes.The ovulation rates of fishes treated with ovaprim were higher. Ovulation rates were highest while using ovaprim at a rate of 0.5 ml/kg body weight of female fish compared to ovulation rates (76.51%) found in the PGE treated and ovulation rates (82.67%) found in the HCG treated fishes(Table 4).In the ovaprim induced individuals, the latency period was within 10 hours while in PGE and HCG induced individuals, the latency period was 15 hours.

Table 4: Showing details of induced breeding of Stinging Catfish, *H. fossilis* using different doses of PG, Ovaprim and HCG

Treatment	Inducing Agent	Doses of hormone	Latency period (hrs)	Ovulation rate(No. of egg released/g of fish)	Incubation period (hrs)
T1	PG	Male-2mg/kg Female-6 mg/kg	15	76.51	5.0
T2	Ovaprim	Male-0.1 ml/kg Female-0.5 ml/kg	10	93.77	3.5
T3	HCG	Male-1000 IU/kgFemale-1000 IU/kg	15	82.67	5.0

Source: Rahman M. et al., 2013

Induce breeding of *Heteropneustes fossilis* using different inducing agents at different doses and combinations

Ali F. *et al*., 2014 studied on the effect of HCG and PG hormone on*H. fossilis.*The breeders were induced with hormone HCG (Male 1250 IU/kg and female 2000 IU/kg), PG (Male 10 mg/kg and female 70 mg/kg), HCG 1250 IU/kg for male and PG 70 mg/kg for female, PG 10 mg/kg for male and HCG 2000 IU/kg for female for treatments T1, T2, T3 and T4, respectively (Table 5). The brood fishes were injected with a single dose. When the brood fishes were injected with HCG the breeding behavior was exhibited quickly and perhaps males lost most of their milt before the ovulation. Whereas, the male and female fishes were injected with PG the eggs and milt released at the contemporary times.Ovulation rate was higher in the HCG treated fish in T1 (77.90 eggs/g of fish) compared to ovulation rates (71.40, 61.75 and 47.44 egg/g of fish in T2, T3 and T4, respectively) found in the PG and different combination of HCG treated fish.

Table 5: Showing details of induced breeding of shing, *H. fossilis* (Bloch) using different doses and combination of HCG and PG

Treatment	Doses of hormone		Latency period (hrs)	Ovulation rate (No. of egg released/g of fish)	Incubation period (hrs)
	HCG (IU/kg)	PG (mg/kg)			
T1	Male-1250 Female-2000	_	9	72	23
T2	_	Male-10 Female-70	7	71.40	24
T3	Male-1250	Female-70	8	61.75	22
T4	Female-2000	Male-10	7.5	47.44	24

Source: Ali F. *et al*., 2014

FERTILIZATION RATEof *H. fossilis* by USING DIFFERENTDOSE of HORMONE

Fertilization rate (%) of *H. fossilis* by using different doses of Flash

The fertilization rates were recorded as 80.33%, 71.97% and 63.56% in the treatments of T1, T2, and T3, respectively(Ali M. *et al.*, 2015). The highest fertilization rate 80.33% was recorded in T1 whereas the lowest fertilization rate 63.56% was found in T3(Figure 6).

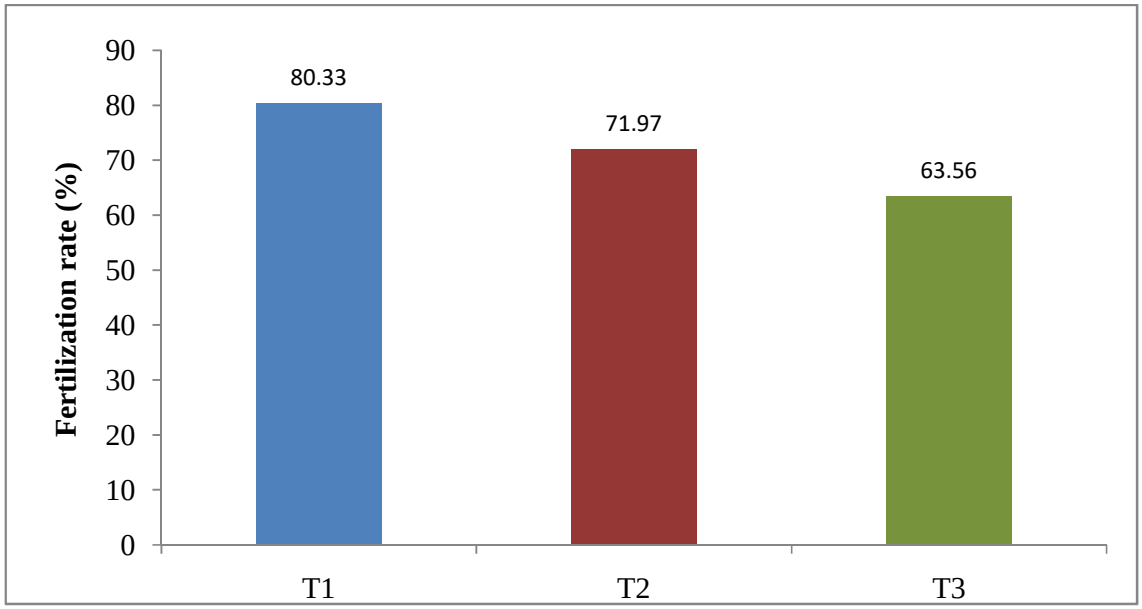


Figure 6. Fertilization rate (%) of *H. fossilis* by using different doses of Flash.

Source: Ali M. *et al.*, (2016)

Fertilization rate (%) of *H. fossilis* by using different doses of PG, Ovaprim and HCG

Induced breeding method in *H. fossilis* was reported byRahman *et al.*, (2013) fertilization rates were higher in eggs of the ovaprim treated brooders (90.83%) compared to the fertilization rates of 70.45% and 75.33% in case of PGE and HCG treated fishes, respectively(Figure 7). Finding of this study agrees previous studies indicating the rate of fertilization is generally higher with ovaprim treatments (Nandeesha *et al*., 1990; More *et al*., 2010). In addition, earlier studies found the fertilization rate of *H. fossilis* treated with ovaprim at 0.3 ml/kg and 0.5 ml/kg body weight as 70% and 75%, respectively (Haniffa and Sridhar, 2002). Furthermore, Begum *et al.* (2001) reported the highest rate of fertilization (98%) in *H. fossilis* injected by PGE at 75 mg/kg. Such deviations in the fertilization rate can

be attributed to the huge differences of hormonal doses, size of the brood fish, seasonal variation (Gheyas*et al*., 2002; Haniffa and Sridhar 2002; Nwokoye *et al*., 2007), environmental factors, water quality parameters (alkalinity, DO, pH, hardness) (Khan *et al*., 2006). The quality of the PGE hormone may also have influencing impact on the fertilization rates.

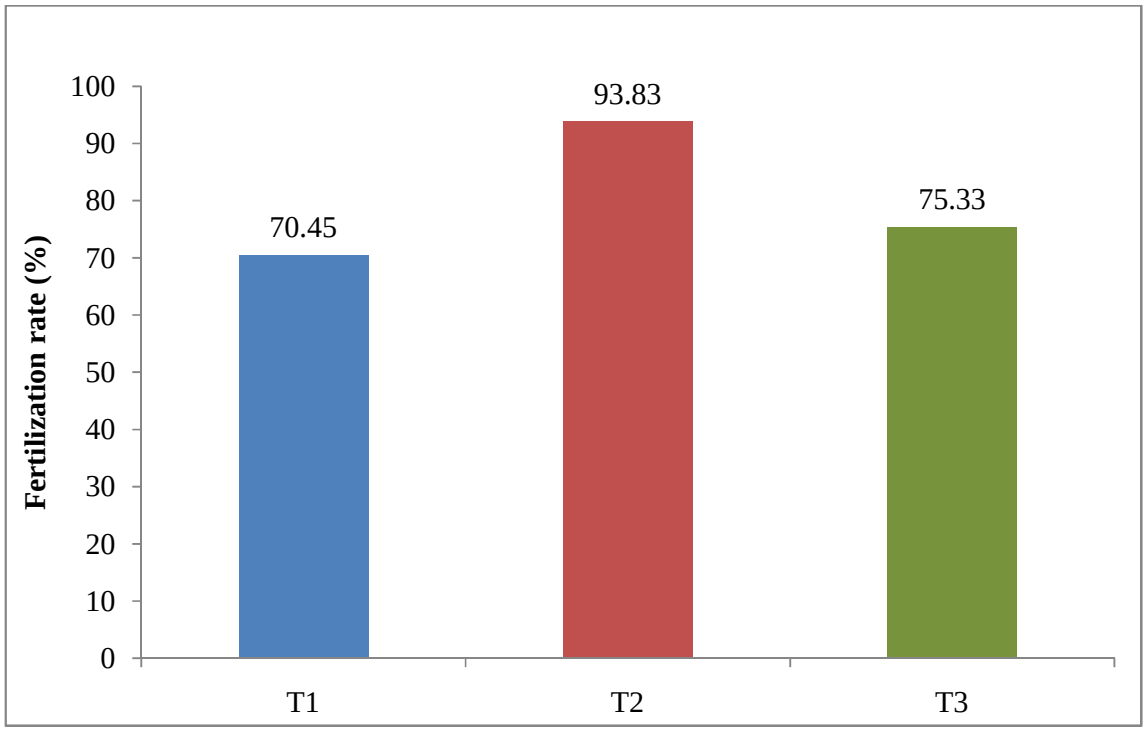


Figure 7. Fertilization rate (%) of *H. fossilis* by using different doses of PG, Ovaprim and HCG.

Source: Rahman *et al*., 2013

Fertilization rate (%) of *H. fossilis* by using different doses and combination of HCG and PG

The study was conducted by Ali F. *et al*., (2014) highest fertilization rates (95%) was recorded in T2 of the PG treated brooders compared to 3 others treatments (Figure 8). The highest rate of fertilization (98%) recorded in *H. fossilis* injected with pituitary gland extract (PGE) at 75 mg/kg which is higher than found in the study of PG injected fishes (Begum *et al*., 2001). Whereas, lower fertilization rates tabulated than the present study as 75.33% and

70.45% in *H. fossilis* injected with HCG at 1000 IU/kg of both female and male fish, and with PGE at 6 mg/kg body weight of females and 2 mg/kg body weight of males (Rahman *et al., 2013*). Differences in the fertilization rate can be attributed to the huge differences of hormonal doses, size of the brood fishes, seasonal variations (Haniffa *et al., 2002;*Gheyas *et al., 2002;*Nwokoye *et al., 2007)*. The quality of the PG hormone could be ruled out as factor influencing the fertilization rates.

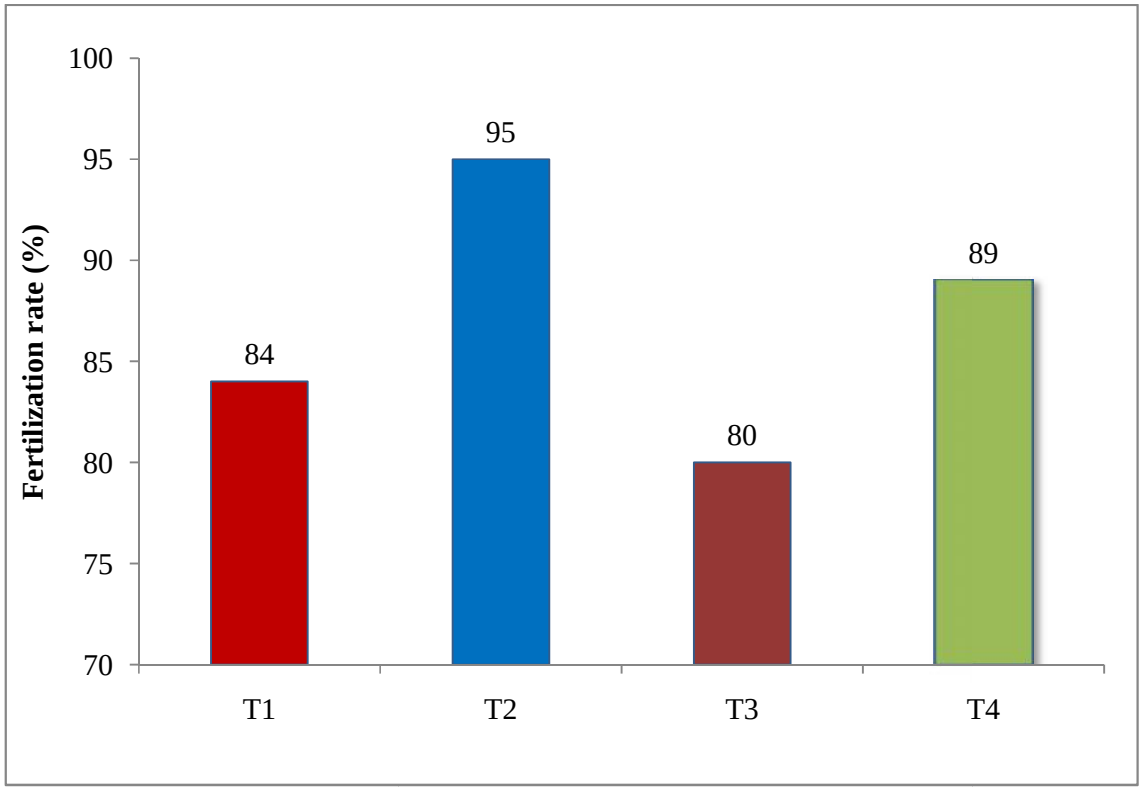


Figure 8. Fertilization rate (%) of H. fossilis by using different doses and combination of HCG and PG.

Source: Ali F. *et al*., 2014

HATCHING RATE of *H. fossilis* by USING DIFFERENT DOSE of HORMONE

Hatching rate (%) of *H. fossilis* by using different doses of Flash

The hatching rate was found 71.67%, 63.35% and 54.47% in treatments of T1, T2 and T3 respectively (Ali M. *et al*., 2016). The highest hatching rate was recorded 71.67% in T1 and the lowest hatching rate was recorded 54.47% in treatment T3 (Figure 9).

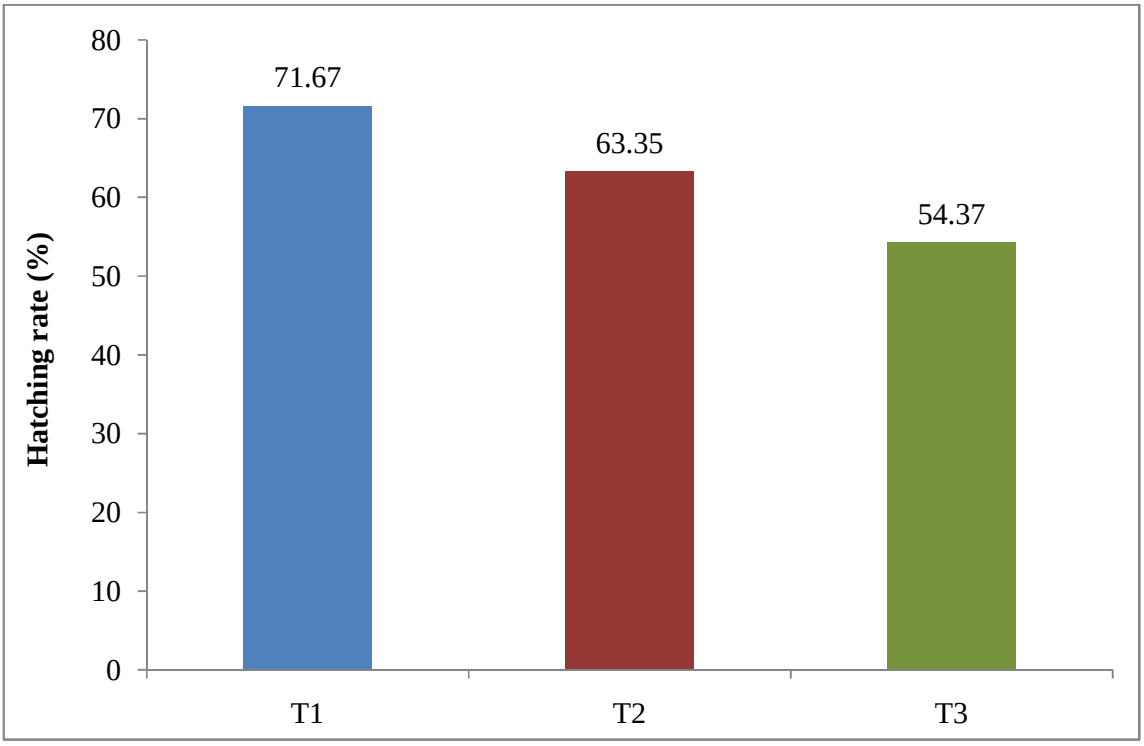


Figure 9. Hatching rate (%) of *H. fossilis* by using different doses of Flash.

Source: Ali M. *et al.*, 2016

Hatching rate (%) of *H. fossilis* by using different doses of PG, Ovaprim and HCG.

Hatching rates were found to be higher by Rahman *et al*., (2013) using ovaprim treated fishes (82.48%) compared to that of PGE and HCG treated fishes (Figure 10). While comparing between experiments it is quite clear that hatchling rates were higher when ovaprim was used at a rate of 0.5 ml/kg body weight of female fish. Nonetheless, Nayak et al., (2001) reported a hatching period of 10- 12 h in *H. fossilis* treated with ovaprim treatment at 27±1º C and obtained higher hatching rate of 96% using ovaprim at the rate of 0.4 ml/kg body weight.

Haniffa and Sridhar (2002) reported a hatching rate 50.5% and 60% for *H. fossilis* injected with ovaprim at a rate of 0.3 ml/kg and 0.5 ml/kg body weight, respectively. However, in terms of hatchling rate, ovaprim treated fish yielded better results compared the PGE treated fish (Nandeesha *et al*., 1990; More *et al*., 2010).

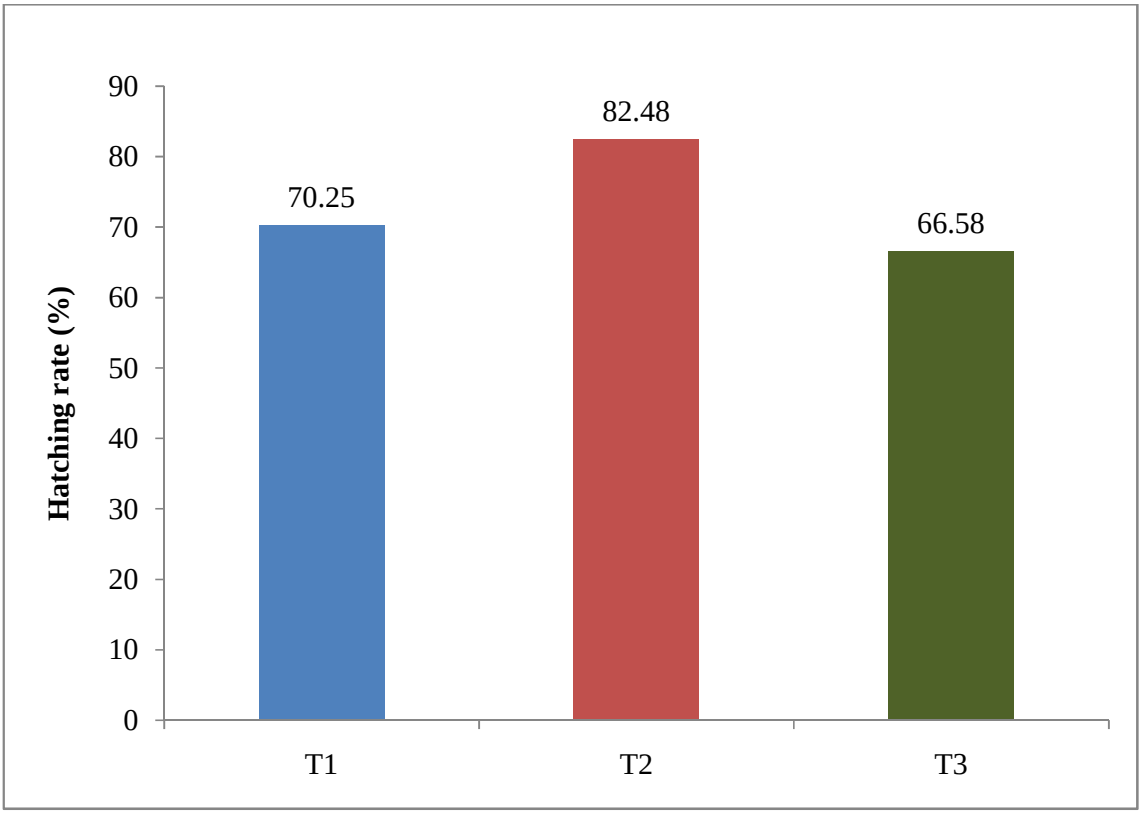


Figure 10. Hatching rate (%) of *H. fossilis* by using different doses of PG, Ovaprim and HCG.

Source: Rahman *et al*., 2013

Hatching rate (%) of *H. fossilis* by using different doses and combination of PG and HCG.

In case ofT2, the hatching rates was found to be slightly higher (88.35%) for eggs comparedto 3 other treatments that of different combination of HCG and PG treated fishes (68.37%,71.2% and 61.32% in T1, T3 and T4, respectively) at 30^0C (Figure 11). While

comparing among thetreatments it is quite clear that hatching rate was higher in T2 than all other treatments(Ali F. *et al*., 2014). Muchlower hatching rates than the present study as 66.58 and 70.25% in *H. fossilis* injected withHCG at 1000 IU/kg of both female and male fish, and with pituitary gland extract (PGE) at 6mg/kg body weight of females and 2 mg/kg body weight of males and obtained a hatchingperiod of 5 h cited by (Rahman *et al*., 2013). The hatching period of shing continued from 18to 20 hrs at temperature ranging from 26^0 C to 29^0C noted in the past (Thakur *et al*., 19740).The embryo hatched out after 21-24 hrs of fertilization stated by (Shaha, 1995). Even though,the incubation period varied from 16-19 hrs at 28-30 0C (Thomas *et al*., 2003).

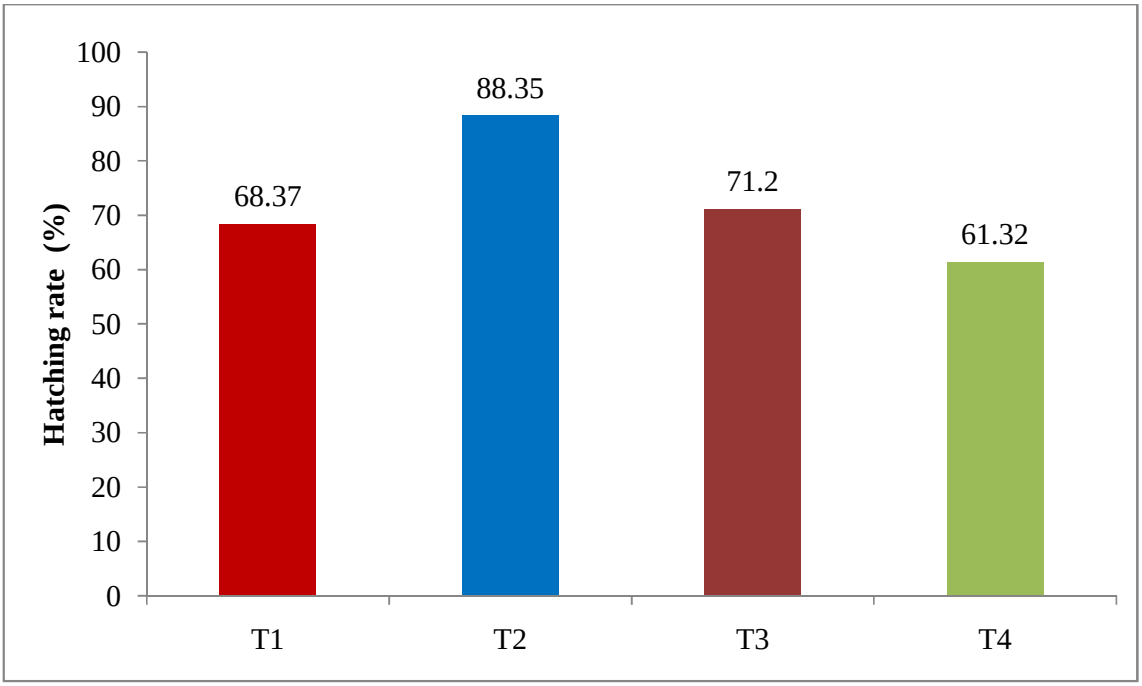


Figure 11. Hatching rate (%) of H. fossilis by using different doses and combination of PG and HCG.

Source: Ali F. *et al*., 2014

Chapter 4

CONCLUSION

Heteropneustes fossilis is one of the most important catfish in Bangladesh. It has been drawing the attention of fish farmers in Bangladesh day by day due to its high market values, profitable culture and hardy nature. Artificial breeding of this species to obtain good quality fry become a necessary part of fry production in the hatchery. Studies on induced breeding of *H. fossilis* were carried out by various researchersin Bangladesh.

This review has conducted to acquire experience on induced breeding of shing, their breeding performance, ovulation rate, fertilization rate and hatching rate. Use of only single hormone for both for male and female at different amount doses and use of two different hormones for male and female at different amount doses are both practice for shing breeding.In case of only single hormone for both for male and female at different amount dosespituitary gland extracts (PGE) and synthetic hormone flash ovaprim and HCG were used. Where PG (Male 10 mg/kg and female 70 mg/kg) found the highest fertilization rate (95%) and hatching rate (93%).When use of two different hormones for male and female at different amount doses showed better then single use of synthetic hormone flash.On the other hand,the male and female fishes were injected with synthetic hormone flash (Male-0.17 ml/kg and female-0.42 ml/kg) showed lowest fertilization rate (63.56%) and hatching rate (54.47%).The ovaprim and PG treated *H. fossilis* fish yielded better results compared to HCG, flash treated fish in terms of fertilization and hatching rates during the presentreview.

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