AG Publishing House

Innovative Approaches in Aquaculture Research (volume-1)

Volume 1
Year: 2025

AG PH Books

Induced breeding of stinging catfish, *Heteropneustes fossilis* using Gonopro-fh in mini portable hatchery and extension education

J. Richwa-ika. Diah. Siangbud[1*], Shadab Siddiqui[2*], Vipin Vyas[3*]

[1]*Department of Zoology and Applied Aquaculture Barkatullah University Bhopal*

[2]*Guest Faculty, Department of Aquaculture, C.S.A. Govt. P.G. College Sehore M.P.*

[3]*Professor, Department of Zoology and Applied Aquaculture, Barkatullah University, Bhopal.*

Abstract

The present study focused on the induced breeding of *Heteropneustes fossilis* (stinging catfish) using the synthetic hormone Gonopro-FH in a mini portable hatchery setup, conducted between August and December 2023 at the Department of Zoology and Applied Aquaculture, Barkatullah University, Bhopal, Madhya Pradesh. A total of 20 healthy brooders were collected, acclimatized, and managed in hygienically prepared tanks. Broodstock were fed a supplementary diet rich in protein and micronutrients to promote gonadal development. The breeding system comprised a specially designed four-tank setup, with an elevated incubation tank facilitating a circular water flow pattern to mimic natural conditions and ensure proper oxygenation. The inner incubation chamber was equipped with a plankton net and vertical outlet for safe egg retention and water exchange. Induced breeding was initiated through intramuscular injections of Gonopro-fh at doses of 0.6 ml for females and 0.4 ml for males. After a latency period of eight hours, females were stripped of eggs, and testes from males were extracted. Fertilization was achieved through manual mixing with distilled water, and the fertilized eggs were incubated in the mini hatchery with continuous water flow. Additionally, as part of an extension education initiative, field demonstrations and training programs were conducted in Behrawal (Shajapur) and Berasia (Bhopal). These sessions aimed to transfer knowledge on induced breeding, hatchery management, and modern aquaculture techniques to rural farmers, enhancing local capacity for sustainable fish farming. This integrated approach not only demonstrated the effectiveness of portable

* ISBN No. - 978-93-49490-24-6

hatchery systems for *H. fossilis* but also contributed to rural development and food security through skill enhancement and technology dissemination

Keywords: Induced breeding, Extension Education, Heteropneustes fossilis.

1 Introduction

Heteropneustes fossilis (Bloch, 1794), commonly referred to as 'singhi' or 'stinghi catfish,' belongs to the sub-order Siluroidei and the family Sacchobranchidae. This species is considered highly suitable for aquaculture due to its strong consumer demand in the Indian subcontinent, owing to its nutritional and medicinal benefits, as well as its high market value. At present, the majority of its production in India is sourced from wild capture fisheries (Nayak et al., 2018), and the limited availability of quality seed poses a significant challenge to its cultivation. To address this issue, the ICAR-Central Institute of Freshwater Aquaculture has developed a standardized protocol for seed production of *H. fossilis* to meet the growing needs of fish farmers (Sahoo et al., 2018).

This species is typically found in natural habitats such as ponds, marshes, ditches, swamps, and occasionally in muddy rivers. It is omnivorous and capable of surviving in slightly brackish waters. Naturally, *H. fossilis* breeds during the monsoon season in confined water bodies, though it can also reproduce in neglected ponds and ditches that accumulate rainwater (Kiran et al., 2016). The singhi catfish is known to inflict a painful sting through venom glands located on its pectoral fin spines. It can grow up to 30 cm in length and is an important component of local fisheries, aquaculture operations, and the ornamental fish trade (Rainer & Pauly, 2011). Its accessory respiratory organ allows it to survive for up to 16 hours out of water, as it does not come into direct contact with the aquatic environment (Mondal et al., 2018).

Induced breeding has emerged as a highly effective technique in aquaculture, especially within composite fish culture systems (Saha, 1995). Hormone-induced spawning works by regulating various stages of the reproductive cycle, either stimulating or inhibiting specific processes. Two main strategies are employed: (1) environmental manipulation to simulate natural spawning conditions, and (2) administration of natural or synthetic reproductive hormones through injection or diet. Often, these methods are used in combination to enhance success. Recent studies and industry practices have highlighted two particularly effective hormone-based approaches: the use of GnRH analogs with dopamine inhibitors and gonadotropin-based injections, as cost-efficient and successful methods for induced spawning. Understanding the embryonic development of *H. fossilis* is essential for advancing artificial breeding efforts, enhancing growth rates, improving farming practices, and gaining insight into species-specific adaptations and habitat preferences (Borcato et al., 2004). The early life stages, embryonic and larval, are also highly responsive to environmental changes, making them important for studying developmental biology and evolutionary relationships (Verreth et al., 1992). Such knowledge is crucial for optimizing larval survival and overall productivity. Hence, this study aims to explore the embryonic and larval development of *Heteropneustes fossilis* under controlled hatchery conditions.

Mini Portable Hatchery

Fig-1: Mini-portable hatchery

Fig-2: Breeding tank

Pattern

Four tanks were taken, an outlet was created at the centre of the two brown tanks and connected with a pipe to the other two black tanks, which are also the inlet of the breeding tank. The breeding tank is elevated slightly above the inlet tank. The breeding or incubation tank consists of two compartments. The inner compartment is equipped with a vertical outlet pipe measuring 2 cm in diameter, featuring holes at various levels to allow excess water to drain out. To prevent the loss of eggs and hatchlings, the walls of the inner chamber are lined with a plankton net.

Working

After mixing milt and eggs, the mixture is dispersed in the breeding tank for incubation. With the help of a motor, the water is pumped up from the inlet tank to the breeding tank. The inlet pipe is positioned 45˚ angle to the wall of the tank for circular motion of water to recreate natural water movement.

2 Methodology

Study area

The present study was conducted in August-December 2023 at the Department of Zoology and Applied Aquaculture, Barkatullah University, Bhopal, M.P., in a portable mini hatchery. Breeding trials of *Heteropneustes fossilis* were performed during the monsoon season.

Fig-3: *Heteropneustes fossilis*

1. Tank preparation and Brood collection

Firstly, the tanks were collected and washed with water and then rinsed with KMnO4 and again rinsed with water in other to prevent germs or any kind of bacteria. The brood fish for the artificial breeding of *H. fossilis* were obtained from Kasturba fish market. And a total of 20 brooders were stock in the tank. Before stocking, the brooders were treated with KMnO4 for 2 minutes per each brooder with the purpose of keeping them from stress or any kind of infection. The mature female fishes can be identified through big-jelly like and swollen abdomen whereas mature male fishes has flattened and pointed genital papillae. All the brood-stocks were acclimatized before the induced breeding procedures and kept separately in tanks.

2. Brood stock management

The brood fishes were fed on supplementary diet from rice bran 20%, mustard oil cake 4%, 1% vitamin premix, earthworm, snail, white portion of boil eggs etc. the brooders were also treated with cow dung and soil manure respectively.

3. Breeding tank (Mini portable hatchery) preparation

Four tanks were taken, outlet is created at the centre of the two brown tanks and connected with a pipe to the other two black tanks which is also the inlet of the breeding tank. The breeding tank is elevated slightly above the inlet tank. There are two chambers in the breeding/incubation tank. The inner chamber is provided with 2cm. diameter vertical outlet with holes at different heights for taking out excess water from the incubation tank. The wall of the inner chamber is covered with plankton net to prevent the escape of eggs and spawns.

4. Hormones

Brooders were injected with Gonopro-FH hormones, and the doses were calculated according to the weight of the fish.

5. Injection of brooders

At a ratio of 1:1, both females and males have been administered intramuscularly synthetic hormone Gonopro-FH at respective doses of 0.6 ml and 0.4 ml as well as preserved in the breeding tank (portable mini hatchery). After 4 hours second dose was administered to both male and female.

6. Stripping methods

After an eight-hour latency period, the female was stripped of eggs, while the male was euthanized to extract the testes. The eggs and spermatozoan were mixed and sufficient distilled water were added to activate the spermatozoan and the mixture is spread in the breeding tank for incubation. And then a continuous shower of water is provided for oxygenation.

Fig-4: Brood tank preparation

Fig 5: Brood collection

Fig-6: Brood selection

Fig-7: Breeding tank preparation

Fig-8: Hormones

Fig-9: Weighing of fish

Fig-10: Stripping of female

Fig-11: Injecting of brooders

3 Results

a. Doses for females and males

Table-1: Doses of Gonopro-FH hormones for male and female of *H. fossilis*

Species name	Sex	Number of Species	Length (cm)	Weight (g)	1st Dosage (ml/kg Body weight)	2nd Dosage (ml/kg Body weight)	Latency period(hrs.)
Heteropneustes fossilis	Male	1	18.8	33.8	0.03	0.02	-
	Female	1	24.4	65	0.04	0.06	12-14

4 Fertilization Rate and Survival Rate

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

b. Survival rate (%) $= \frac{\text{No.of survival fry} \times 100}{\text{Total no. of hatching}}$

Table-2: Fertilization rate and Unfertilization rate of *H. fossilis*

Species name	Fertilization rate (%)	Unfertilized rate (%)
Heteropneustes fossilis	70%	30%

Table-3: Survival rate and Mortality of *H. fossilis*

Species name	Survival rate (%)	Mortality rate (%)
Heteropneustes fossilis	15%	85%

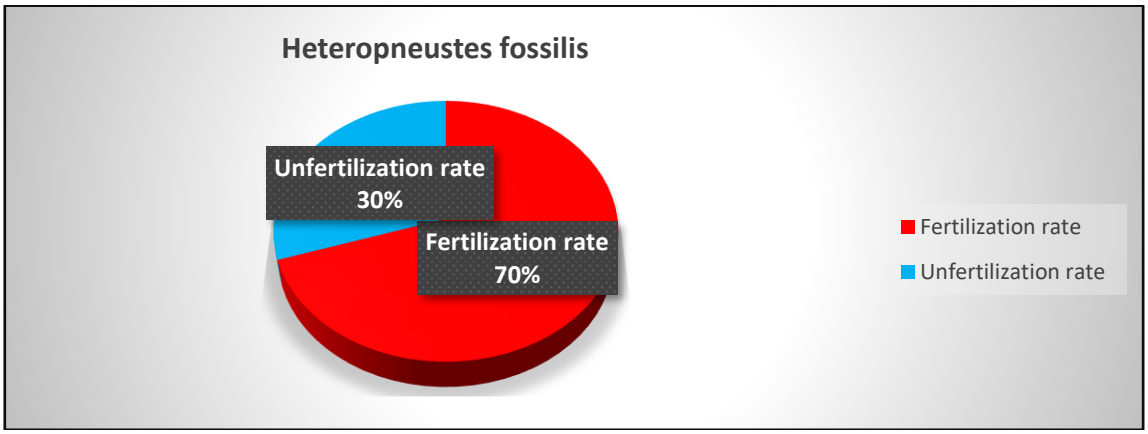

Fig-12: Pie chart of Fertilization rate and Unfertilization rate

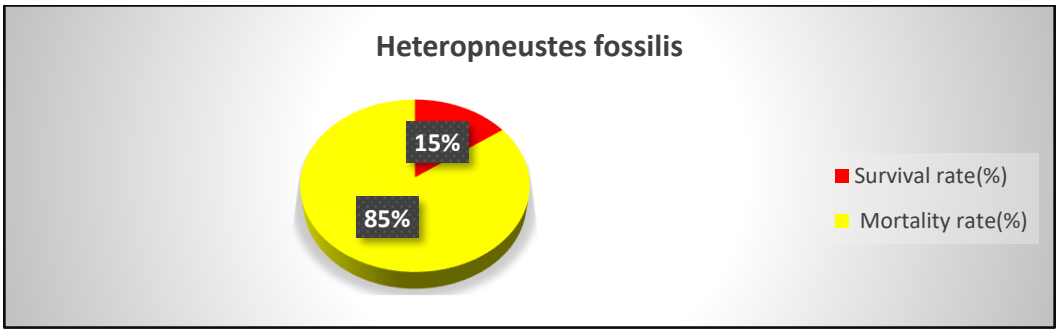

Fig-13: Pie chart of Survival rate and Mortality rate

5 Extension Education

Farm extension services are crucial for the advancement of agriculture-based communities. The cultivation of both shellfish and finfish in aquaculture is increasingly acknowledged as a key strategy for promoting rural development and ensuring food and nutritional security for rural populations. Two places, Behrawal (Shajapur) and Berasia (Bhopal), were selected for the study. Training on induced breeding, breeding techniques and demonstration of a mini portable hatchery. The purpose of the training was to: upgrade their existing operation farm management skill, enhance their skills and knowledge, utilized their pond area for modern fish culture, and improve productivity and ultimately lead to rural development.

Fig-14: Training on Induced Breeding

Fig-15: Demonstration of mini portable hatchery in Semra Kalan

Fig-16: (a and b): Demonstration of mini portable hatchery in Behrawal

References

[1] Saha, J.K., Islam, M.A., Das, M., Rahamatulla, S.M., & Islam, M.S. (1998). Studies on the induced breeding and post-larval rearing of shing (Heteropneustes fossilis Bloch). Bangladesh Journals Fish Research. 2(2): pp.139-144.

[2] Forhad Ali, M., Mamunur Rahman, Md., Khairul Bashar, Md., Rahmatullah, R., Hadiuzzaman, Md., & Ruhul Amin, Md. (2014). Comparative study on induced breeding of shing, *Heteropneustes fossilis* (Bloch) between HCG and PG with different combination. International Journals of Fisheries and Aquatic Studies. 2(2): pp. 104-108

[3] Trygve, G., Nick, R., Morten, R. (2012). The importance of selective breeding in the aquaculture to meet future demands for animal protein: A review. Volumes 350–353:pp. 117-129.

[4] Rahman, M., Hossain, Y., Provhat, S.J., Islam, M.S. & Hossain, B. (2013). Induced breeding of the Stinging catfish, *Heteropneustes fossilis*: comparison among different inducing agents. Turkish Journal of Fisheries and Aquatic Sciences. 13: pp. 523-527.

[5] Sahoo, S.K., Ferosekhan, S., Tiwari, P.K., Giri, S.S., Sivaraman, I. and Sahoo, S.N. (2023). Breeding, Seed production and Grow-out Culture Technologies of Commercially Important Catfishes in India. ICAR-Central Institute of Freshwater Aquaculture, Bhubaneswar, Odisha, India. pp: 1-26.

[6] Poul S.K., Sarker S., Sarker B.S., Alam M.M., Majumdar P.R. (2022). Breeding biology and dose optimization for captive breeding of striped catfish Mystus vittatus using different hormones. Iranian Journal of Fisheries Sciences 21(1): pp. 104-121.

[7] Saikia, C., Singh, M.K., & Sonowal, S (2022). Captive breeding of the stinging catfish, found in Brahmaputra River, Assam, India using inducing agent ovasis and its early embryogenesis.

Egyptian Journal of Aquatic Biology & Fisheries Zoology Department, Faculty of Science. 26(5): pp.161-173.

[8] Goswami, P.K. & Devaraj, M. (1992). Breeding age and growth of the freshwater shark Wallago attu (Bloch and Schneider) from the Dhir Beel of the Brahmaputra Basin, Assam India. Journals of the Indian Fisheries Association. 22: pp 13-20.

[9] Mondal, Md. S. and Ghosh Subrato. (2018). Concept of seed production of *Heteropneustes fossilis* in farmers' fi elds in West Bengal, India. Aquaculture. Volume 22 No. 4.

[10] Olufeagba S.O., Raji A., Majumda K.C., Ravinda K., Okomoda V.T. (2015). Induced Breeding and Early Development of Stinging Catfish, *Heteropneustes Fossilis* (Bloch) (Siluridae). International Journal of Aquaculture, Vol.5, No.13, 1-7