

Concept of seed production of *Heteropneustes fossilis* in farmers' fields in West Bengal, India

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Heteropneustes fossilis male brood fish.

Distinguishing features of *H. fossilis*

The freshwater catfish *Heteropneustes fossilis* can inflict a painful sting and wound with its pectoral fin spine on hands of fish farmers, if handled carelessly or when provoked. Poison can emanate from a gland in the pectoral spine of male fish. When the spine penetrates the body of handlers, it presses its base against the venom-containing cells, squashes them and squeezes the venomous contents into the wound in victim's skin and underlying tissues. Quite intense pain develops at site of injury, progressively extending to surrounding areas. Secondly, it possesses two tubular pulmonary air sacs, which run backwards on either side of the vertebral column almost up to the caudal peduncle from gill chamber through the myotome muscles in the back. This accessory respiratory organ of the fish never comes in direct contact with the aquatic environment and can allow the fish to survive for about 16 hours out of water. Thirdly, *H. fossilis* is a high-priced fish, well regarded for its high nutritive and medicinal values and invigorating qualities from time immemorial.

Brief history

2016 marked the 60 years since the first successful induced breeding of *H. fossilis* in India. It was performed by Dr L. S. Ramaswamy and his research student B.I. Sundararaj in June 1956 at Bangalore Central College, under the then Mysore University, using pituitary gland from the same species. In the 1984 breeding season at Hessaraghatta Fish Farm, Bangalore, success was achieved in induced breeding

of *H. fossilis* in the All India Coordinated Research Project on air-breathing fish culture; pituitary gland extract was used @ 30 and 90-120mg/kg body weight as 1st and 2nd injections respectively to females (100 g) and 30-50mg/kg as a single injection to males (60-80 g)¹. In 1998, Dr M. A. Haniffa and co-researchers at St. Xaviers' College, Palayamkottai, India had developed a low-cost simple breeding and egg incubation/hatching technique for *H. fossilis*, which could easily be adopted by rural fish farmers². In 2017, the same researchers reviewed the seed production of *H. fossilis* by induced breeding, and emphasised 'Seed production as an urgent need for *H. fossilis* farming in ponds'³. In 2000, scientists at ICAR-CIFA, Bhubaneswar standardised the technique of seed production of *H. fossilis*.

Brood stock maintenance and breeding

As practiced at Mondal Hatchery and other leading *H. fossilis* seed production units in West Bengal, females 18 months of age (weighing 200-250 g) are preferred as broodstock for induced breeding. Females become mature with ripe oocytes at 9-10 months of age but the males are not yet mature at this age. Males weighing 120-160 g are selected. Broodstock of both sexes are prepared from 8 months old by rearing for 8-9 months in small ponds (water depth: 105cm), stocked @ 18,000-20,000 fish in 1,335 m² ponds (water depth 1 m). In such ponds, *Anabas testudineus* 50-200g size are also stocked @ 1,500-2,000, which enhances dissolved oxygen content and helps in auto-oxygenation in the pond with the help of their accessory respiratory organ. Commercially available floating pelleted feed (beginning with 3mm and ending



Advanced fry of *H. fossilis*.

with 6mm diameter) are fed twice daily 5:00 and 18.00 hours @ 9% of total biomass. For *H. fossilis* and *Ompak pabda*, feeding the fishes at sunrise and during sunset gives a good result. The vent of the females turns pinkish with a blunt navel-like state. For *H. fossilis*, each breeding set comprises 6-8 males and 4 females. Commercially available fish pituitary gland stored in processed and dried form, supported with zinc powder and cotton in small vials with rubber cork, is used as inducing agent. Females are given two injections of pituitary gland extract at an interval of three-and-a-half hours and single injection is applied to males.

Dry stripping method and nursing of larvae

In the dry stripping method, in conditions when non-release of eggs occurs seldom in case of *H. fossilis* females due to 'plugging' of genital pore, fresh tubewell water is boiled and those fishes are kept in mildly hot water for 25 mins; which facilitates loosening of 'plugged point' and 75% release of ova. Brood fishes are ready to be stripped four hours after injection of the females. A pair of testis from male fish is dissected out and homogenised or squeezed through a cotton cloth using 2% saline solution. The milt is further diluted with 1 part water added to every 2 parts of saline-associated milt, and spread over the stripped eggs. Sperm and eggs are mixed well with a feather for 3-4 mins and fertilised eggs are washed with freshwater. They are greenish-blue/greenish-brown in colour and demersal in nature. The eggs are incubated in individual mini rectangular trays of dimension 25cm x 20cm x 5cm. Water hardness 250-400 ppm favours incubation of *H. fossilis* eggs, whereas for *Clarias batrachus* the ideal concentration is 100ppm.

As observed, after an incubation period of 9.5-10 hours at 29-30°C water temperature, *H. fossilis* larvae begin to hatch, measuring 7-8 mm on the third day. This stage is stocked in rectangular chambers of 3 m x 1.8 m dimension with a water depth of 30 cm. About 30,000 larvae are obtained from

every four females. Early fry/advanced larvae are stocked @ 45,000-60,000 / chamber. In each chamber, four bubble diffuser-type oxygenation machines are introduced. Growing larvae are fed two times a day with a mixture of 2-3 boiled chicken eggs and 100 g milk powder mixed with 3 litres of water in each such chamber. On summer days with strong sunshine, 30-40 g of glucose powder is mixed with 2 litres of water and sprinkled over each rearing chamber. In addition to this, oxygen powder (marketed by Gabbro Company) is applied at one-third of a teaspoon per chamber. *H. fossilis* larvae measure 15-18 mm six days after stocking; these are harvested from chambers and stocked in pre-prepared productive nursery ponds @ 200,000 / 1,335 m². The fish attain 3.8-4.8cm in length after 20-22 days of rearing. Dust-type supplementary fish feed from CP is used two times a day @ 12% of body weight in each nursery pond.

These fish fry and advanced fry of *H. fossilis* (pure variety; 1,500-1,600 pieces weighing 1kg) are sold @ Rs 2.60/- / piece. They are considered as 'Grade-A'. In fish seed wholesale markets, 'Grade-B' type of advanced fry of *H. fossilis* may also be available for sale (Rs 1.80/- / piece), which is basically a cross-bred variety of male *Clarias gariepinus* and female *H. fossilis* produced in hatcheries.

Induced breeding using Ovaprim and live larval feed

If a single dosage of Ovaprim or Gonadoprime is applied to mature females and males @ 2 ml and 1 ml / kg body weight respectively, they release gametes spontaneously and fertilisation occurs, stripping is not required. Female *H. fossilis* can be induced to breed twice at an interval of 45 days. Brooder management may be done from January until early May and in its initial phase, a low dose of pituitary gland extract @ 0.2ml / kg is applied only to females, which were not used for breeding in previous season. Some catfish breeders in North 24 Parganas and South 24 Parganas districts maintain *H.*

fossilis broodstock at low densities, ie. 100 fish in every 33 m² pond. ICAR-CIFA broodstock pellet feed is used (Rs 73/- / kg) @ 5% of body weight daily and 500 g boiled rice is used in addition to it for every 100 fishes.

To the four-day old growing *H. fossilis* larvae and onwards, some fish breeders prefer to provide cultured microworms as food. Plastic tiffin boxes are used as culture container and sliced bread (four sides/edges removed) used as culture medium base. A small amount of old microworm culture stock is used as inoculum over bread surface. A mixture of distilled water and yeast is spread over medium base until it gets fully wet. A box with drilled pores on the lid is kept closed and after four days, yellowish microworms 1mm in length are produced. Bread with inoculums may be soaked in beer. *Artemia* nauplii may also be provided to them in larval rearing chambers. In 20 litre drinking water containers, 200-220 g of salt is added to make up a 10-12ppt concentration and a small teaspoon full of *Artemia* cysts are added. Under sufficient aeration, freshly produced nauplii are washed thoroughly with freshwater for 2 minutes and subsequently fed to *H. fossilis* larvae. In the absence of diffuser-type oxygenation machines, artificial showers/water sprinklers must be installed over larval rearing chambers to aerate the water. Fry stage and above are not cannibalistic in nature. The first author may be contacted for dosage of induced breeding using commercially-prepared dry pituitary gland and for other details.

End note

The pond farming of *Heteropneustes fossilis*, *Puntius sarana*, *Labeo gonius*, *Cirrhinus reba*, *Anabas testudineus*, *Mystus vittatus*, *M. cavasius*, and *Ompak pabda* is not a usual

practice in India, and these fishes are considered as new candidate species in freshwater pond aquaculture. Fry and advanced fry of major carps are sold at a price per kilogram, but those of non-conventional cultivable fishes, like medium carps, climbing perch, non air-breathing and air-breathing catfishes are sold at a price per piece. Progressive fish breeders are much more interested in production of the latter which is undoubtedly more profitable. Through application of induced breeding technique, better quality fish seed of selected species and varieties are produced in modern fish seed farms in West Bengal under controlled conditions in specific supply periods in commercial scale; these are made easily accessible to fish farmers in nearby and distant regions, even in Bihar and Jharkhand for grow-out culture. In rural aquaculture, following modified-extensive method of farming, 350-360kg of marketable-sized *H. fossilis* may be produced from every 1335 m² pond at the end of six months.

References

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Haul of pond reared *H. fossilis* in market.