

Captive breeding and larval rearing of *Cirrhinus reba*, a small indigenous fish of aquaculture importance

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Wild collection of *Cirrhinus reba*.

The technique of induced breeding and seed production has led to a boom in aquaculture production around the world. Aquaculture is one of the fastest growing food production sectors, providing food and livelihood security to millions of people across the globe.

In India, freshwater aquaculture is dominated by Indian major carps (*Labeo rohita*, *Gibelion catla* and *Cirrhinus mrigala*) and exotic carps (*Hypophthalmichthys molitrix*, *Ctenopharyngodon idella* and *Cyprinus carpio*), which together presently contribute about 90-95% of the total freshwater production of the country. However, India is known for its rich diversity of carps in its freshwater ecosystems. The country is blessed with 15-20 varieties of minor and medium carps that have a high potential for freshwater aquaculture. These species can be considered as alternatives to the major carps for diversification in freshwater aquaculture.

C. reba or 'reba carp' is a commercially important indigenous minor carp species distributed over south Asia. It is highly popular among consumers due to its taste, oily flesh, and nutritional value, being a good source of minerals and protein. It is mostly distributed in rivers and wetlands of India, particularly in the north-eastern states Assam, Meghalaya, Arunachal Pradesh, and Tripura. A herbivorous species, *C. reba* has been identified as a priority species for aquaculture diversification in India and has great scope for incorporation in carp culture and polyculture systems. If juveniles are available in adequate numbers, reba carp can be widely accepted as a cultivable fish because of its high market value and consumer preference, which can also serve its conservation. Apart from its food value, reba carp can also be regarded as an ornamental fish of economic importance. It has a striking appearance due to the presence of hexagonal scales throughout its body with a dark transverse band throughout its entire length. The need for conservation and propagation of indigenous fish species in recent years has resulted in increased interest in the breeding and culture of indigenous reba carp.

Broodstock management

For broodstock development, fingerlings were collected from the wetlands of Morigaon District, Assam, and were brought to the College of Fisheries farm at Assam Agricultural University (AAU), Raha. The fingerlings were reared for one year in the earthen ponds of 0.02 ha. During the one-year rearing period, liming, and manuring were done following the standard guidelines mentioned in the package of practice of AAU. Throughout the culture period, a minimum water depth of 1.0-1.5 metres was maintained with frequent water exchange during the winter season. The fish were fed with farm made formulated feed comprising soyabean meal, mustard oil cake, rice polish and vitamin and mineral mixture, with a crude protein content of 30-32%. The feed mixture containing all the ingredients was sieved through a fine meshed screen and mixed with water to make dough. The feed mixtures (mash or moist feed) are kept in perforated fertiliser bags tied to bamboo poles. Feed was transported on a small raft and distributed in the feeding bags. Fishes browse on the feed through perforations in the bag and within two hours the feed was consumed. About 20-30 bags can be used per hectare of waterbody. The fish attain maturity after one year and males/females weigh around 150-250 g at the peak breeding season of May-June. Males are of a smaller size than females and attain maturity faster. Female broodstock attain a size of 15.5-16 cm and weigh 200-250 g while male broodstock attain a size of 13-14.5 cm weighing 90-120 g. During the breeding season sexual dimorphism can be easily observed. The females exhibit a bulging abdomen with more prominent dark band across the lateral line, which is a unique characteristic of *C. reba* brooders. Since the fish are minor carps, applying slight pressure to the abdomen for check for milt and eggs causes mortality and should be avoided. For the breeding experiment, male and female fish were taken in the ratio of 3:1, unlike that of Indian major carps where a 2:1 male/female ratio is maintained. Prior to breeding male and female broodstock of *C. reba* were kept in a separate breeding hapa at the spawning pool of the AAU model carp hatchery. Induced breeding was carried out during evening hours at an air temperature of 24-25°C. Ovafish, a synthetic inducing agent was administered at the rate of 0.5 ml/kg body weight for females and 0.25 ml/kg body weight for males. Both males and females were released into the spawning pool after injection. After 7-8 hours eggs were released by the females and were collected in the early morning. The spent fish were dipped into potassium permanganate solution ($KMnO_4$) and then released back into the stocking pond. Eggs hatched after 24 hours of incubation at the carp hatchery.

Larval rearing of *Cirrhinus reba*

The water temperature at hatching was of 24°C. A total of 140 broodstock were injected with 35 females and 105 males. The average fecundity was around 55,000 per 200 g of female brooders. The hatchlings were 1.75-2.1 mm in length and a prominent dark band was observed under the stereo zoom microscope. Approximately 0.6 million hatchlings were obtained during the breeding season and were released into a nursery tank of 0.01 ha. All the better management practices of carp farming were followed during stocking of the spawn. To observe the food preference of hatchlings some fishes were put in a glass aquarium. The hatchlings fed on green



Female *C. reba* broodstock.



Farm raised *reba* carp broodstock.



Stereozoom microscopic image of *C. reba* fry.

algae attached to the glass panes of the aquarium and acted as algae cleaners in the aquarium. Their feeding behaviour exhibits the herbivorous feeding habit of *C. reba*.

Culture prospects as alternative carp species

C. reba fetches a better price than the Indian major carps in different parts of the country. It is a highly fecund fish and this may be advantageous for short duration culture in seasonal water bodies. Marketable size is 100-300 g as compared to 700 g-1.5 kg for major carps. It is compatible with Indian major carps in composite fish culture. As the fish is herbivorous in nature it can easily digest plant protein sources. Therefore, different plant based agro-industry by-products, which are rich in protein and abundantly available in India, can be used for low-cost feed formulation for the species, which is easily domesticated in pond environments and readily accepts artificial feed. *C. reba* also have potential in aquarium trade, particularly as juveniles.

The need for diversification of farmed fish species in recent years has resulted in renewed interest in the breeding, propagation and culture of *C. reba*. This has resulted in successful induced breeding of *C. reba* for the first time in Assam, where the fish has high market demand with price ranging from Rs. 400-500 / kg in local markets. To make aquaculture more profitable new species should be introduced into farming systems which could be a successful step towards species diversification.

From a conservation point of view the successful breeding and seed production of *C. reba* achieved by College of Fisheries, Assam Agricultural University, Raha will surely generate availability of fish seed of this species which will overcome the decline in wild population and safeguard the species for the future.

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Above, below: Breeding and larval rearing of *Cirrhinus reba*.



Better management practices adopted in *Cirrhinus reba* culture

Pond preparation	Pond drying (sun dry for 10 days). Lime application @ 300 kg/ha of agricultural lime. Manuring @ 6,000 kg/ha of raw cow dung/poultry manure. Inorganic fertiliser: Urea @10 kg/ha and single super phosphate @15 kg/ha applied fortnightly.
Water quality parameters	Dissolved oxygen: 5-6ppm. pH: 7.5-9. Alkalinity: 25-150 ppm. Hardness: 100-130 ppm. Nitrate: 0.2-0.5ppm.
Feeding practice	Feed mixtures were given in feed bag. Each bag contains 2-3 kg of feed. Bags were kept on bamboo poles within 30 cm of water.
Fish health management	Monthly fish sampling was done to check the health and growth. The body surfaces were checked for the presence of parasites. Potassium permanganate treatment was done as a prophylactic measure.