UNIT:5
(AQUACULTURE)

Induced Breeding

11.10. INDUCED BREEDING IN FISHES

The Blue Revolution in India during seventies and eighties of 20thcentury was largely made possible due to the technology of induced breeding in fishes. The credit for this technology in India goes to Central Inland Fisheries Research Institute Barrackpore; West Bengal that succeeded in inducing the Indian Major Carps to breed in captivity for the first time in 1957.This technology was gradually taken to field and adopted by the fish farmers.

Prior to the technology of induced breeding, the general practice for fish culture in India was based on collection of seed of Major Carps from natural riverine habitat as these fishes do not breed in captivity. The seed thus collected from riverine habitats used to contain uneconomical, undesirable and predatory species as well. This was a major hindrance in successful fish farming in India.

11.10.1. Definition

Induced breeding is a technique in which ripe/ gravid fishes are stimulated to breed in captivity by the introduction of pituitary hormone/human chorionic gonadotropin/ovaprim (synthetic

hormone). The stimulation by the injection of gonadotropin results in the release of gametes (eggs and sperms) by the fishes.

11.10.2. Advantages

Induced breeding practice became very popular in India as it helped the fish farmers in overcoming many hurdles faced otherwise in fish farming. Some of the advantages of this technique are :

1. Pure fry of any desired species of fish can be obtained through induced breeding. This was not the case earlier because fish seed collected from natural habitat used to be mixed, containing the fry of predatory fishes as well and sorting of pure seed of desired fish was simply not possible.
2. The seed can be produced as per the demand of a particular carp species.
3. The availability of seed for fish culture is assured as it does not have to be dependant on monsoon rains unlike natural spawning.
4. The production of seed through this technique has proved economical as the collection of spawn from natural habitat used to be labour intensive and hence expensive.
5. The technique has made it possible to raise seed at the site of fish culture itself thereby doing away with the transportation problem of seed, from far away natural habitat to culture pond.

11.10.3. Hypophysation/breeding with pituitary gonadotropin

Hypophysation is the method of inducing the fish to breed with the help of pituitary/hypophysis extract that contains gonadotropins like FSH and LH which bring about the maturation of gametes and their release. The process of induced breeding with the help of pituitary gonadotropin is accomplished in following steps :

A. Collection and preservation of pituitary
B. Extract preparation
C. Selection of brood stock
D. Dose determination and administration of extract
E. Spawning
F. Hatching

A. Collection and preservation of pituitary

Pituitary gland or hypophysis is the most important gland in the endocrine (gland) diversity as it secretes lot many hormones some of which control the secretion of other endocrine glands as well. Morphologically, it has two parts, adenohypophysis (glandular part) and neurohypophysis (nervous part). The adenohypophysis has three lobes, anterior (pro-adenohypophysis), middle lobe (meso-adenohypophysis) and posterior lobe (meta-adenohypophysis). The middle lobe secretes gonadotrophic hormones that include FSH and LH. These hormones bring about maturation of gonads and stimulate the production and release of eggs and sperms in fishes. Thus pituitary gland plays a vital role in the spawning of fishes.

For inducing the breeding among fishes, pituitary gland is collected from some donor fish and its extract prepared for administration into the brood fishes. The gland is collected from fresh or ice preserved mature donor fish that are readying for spawning. Although pituitary extracts do not show any species specificity and the gland can be collected from any ripe fish, the donors of related species are preferred for more effective results. The common carp makes an ideal choice for collection of pituitary gland as it breeds year round and hence mature brood fish are available whenever needed.

The pituitary gland can be collected by any of the following 2 methods :

(*a*) The scalp or skull of the donor fish is cut open with the help of butcher's knife. The fat surrounding the brain is removed carefully. The brain is lifted after cutting the olfactory and optic nerves to detach it. The pituitary gland is located ventrally just posterior to the crossing of optic chiasma in a thin membrane. On removing the brain, pituitary gland gets exposed. It is carefully lifted with the help of forceps and put into absolute alcohol.

(*b*) The second method appears to be more convenient and easy. In this method the head of the donor fish is cut from the body and the foramen magnum exposed. The forceps are introduced into

the skull through the opening of foramen magnum. The fat covering the brain is removed gently and the brain is detached by cutting the olfactory and optic nerves. The brain is now taken out through foramen magnum and pituitary gland carefully lifted.

B. Extract preparation

The pituitary gland thus collected is preserved in absolute alcohol. The preserved gland is either processed for the preparation of extract or stored as such at room temperature for use at later stage.

For the preparation of extract, the requisite quantity of gland is taken as per the dosage schedule and macerated in a homogenizer after mixing it with distilled water or 0.3% saline water. The homogenized gland is further diluted as per the requirement of the recipient fish on the basis of 0.2 ml/kg body weight. The diluted extract is then subjected to centrifugation to separate out the suspended particles which settle at the bottom. The supernatant fluid is the pituitary extract that contains the hormones.

The extract thus obtained is either administered fresh or preserved in glycerin and stored at room temperature or kept under refrigeration for later use. For storage purposes, 4 parts of preservative (glycerin) are added to 1 part of extract.

C. Selection of brood stock

The potential brood fish, that are healthy, fully ripe/gravid, weighing in the range of 2 – 3 kg, are selected for induced breeding. Very large brood fish are not selected as these are difficult to handle. Ripe males are identified easily on the basis of denticulation (presence of tubercles) and roughness of the dorsal side of pectoral fins that are longer and stronger. On gently pressing the abdomen, the milt oozes out of the male brood fish. The female brood fish has soft and bulging abdomen in addition to a swollen; reddish genital papilla.

These prospective recipients of pituitary extract for spawning are taken out from the main fish stocking pond and reared in a separate pond. The pond is prepared in advance for intensive rearing of these potential brood fish through liming and manuring. The brood stock is given artificial feed in the form of rice bran and mustard oil-cake (1 : 1) daily @ 1 – 2% of body weight to supplement the natural food available in the pond.

D. Dose determination and administration of extract

Dosage of pituitary extract to be administered into the brood fish for inducing spawning depends upon the sex and state of readiness of the gonads of recipient and body weight. Female fish are given two injections and the dose of each one is determined on the basis of their body weight. Indian major carps are given preliminary dose of 2 – 3 mg/kg body weight and the second dose of 5 – 12 mg/kg of body weight of pituitary is administered after an interval of 6 hours. At this point of time, male fish are also given single dose of 2 – 3 mg/kg body weight. However exotic carps, like silver carp and grass carp, respond only to a higher dose. The female fish of these two species are administered pituitary extract of 9 – 14 mg/kg body weight in two doses at an interval of 3 – 6 hours while male brood fish are given single dose of 3 – 4 mg.

The pituitary extract is administered in the region of caudal peduncle of the recipient. The intramuscular injection is given with the help of hypodermic syringe of 2 ml capacity, graduated to 0.1 ml. For the administration of extract, the recipient fish is kept in the hand net and laid on its side (Fig. 11.8). Although there is no specific timing of the injection, yet the preliminary one is generally given at noon and the second dose administered in the evening.

E. Spawning

The brood fish, after receiving pituitary injections, are released into the breeding hapa. This hapa is a mosquito net-cloth lined enclosure, measuring about 3m × 1.5m × 1m and fixed in the pond by 4 bamboo poles at 4 corners. One set of brood fish, comprising 2 females and 1 male are introduced in each hapa.

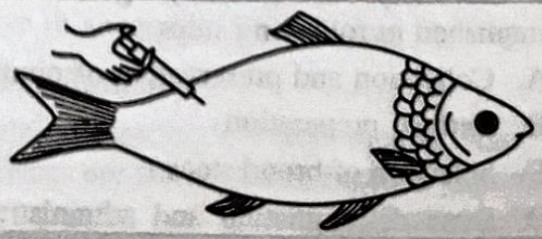

FIGURE 11.8. Injection of pituitary extract

Spawning occurs in 3 to 6 hours after the administration of second dose of pituitary extract to females. The spawning is preceded by a sort of **sex-play** by the fish where in the female fish swims faster followed by the male. The female goes on splashing the water and releasing the eggs and the male sheds its milt while following the female. This synchronized spawning results in the fertilization of eggs.

F. Hatching

The fertilized eggs are collected from the breeding hapa about 6 – 8 hours after fertilization. These fertilized eggs are transferred to hatching hapa which is actually made of two separate hapas, one fitted inside the other. The outer hapa is a thick cloth lined enclosure while inner hapa is lined by mosquito net-cloth.

The fertilized eggs are placed gently into the hapa so as to help them settle at the bottom. About 1 lakh eggs are placed in each hapa. It takes about 15 to 18 hours for the eggs to hatch at normal temperature. The hatchlings start moving out through the net cloth into the outer hapa. The inner hapa, containing the egg shells of hatched eggs and the unfertilized opaque eggs, is removed while hatchlings are left undisturbed in the outer hapa for 3 days till yolk sac is absorbed. At this stage, as the early fry are ready to commence exogenous feeding, they are transferred to the nursery pond.