

GLASSJAR HATCHERY FOR INDIAN MAJOR CARPS AND CHINESE CARPS

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INTRODUCTION

Hatcheries are in intensive use in countries like U.S.A., (Burrows and Palmer 1955) U.S.S.R. (Konradt 1966), Hungary and Switzerland for raising seed of cultivated fishes such as salmons, carps, perches and mullets (Huet 1970). Subsequent to the success of induced breeding of Indian major carps (*Catla catla*, *Labeo rohita*, *L. calbasu*, *Cirrhinus mrigala*) (Chaudhuri and Alikunhi 1957) and chinese carps (*Ctenopharyngodon idellus*, *Hypophthalmichthys molitrix*) (Alikunhi et al 1963), in India, the need for development of hatcheries was emphasised so as to reap maximum crop of fish seed from the huge quantities of eggs produced by the hypophysation technique. The prevalent practise for incubation and hatching of carp eggs is to use the Hapas (cloth containers) fixed in stagement pond water. (Chaudhuri 1963), Bhowmick and Chaudhuri 1968). This Hapas system of hatching entails heavy loss of fish seed at various stages of development due to several factors which are beyond control under the field conditions. However, when the prevailing field conditions are favourable, the survival of fish seed is satisfactory but such conditions are not always to be found in the field. Apart from this, the Hapa system requires a large number of cloth hapas every year involving heavy recurring expenditure (Bhowmick 1972).

With a view to tackling the problems associated with incubation, hatching and survival of spawn of carps, a hatchery comprising cone-shaped glass jars has been designed and installed at Cuttack in 1970 for the first time in the country. The various components of the hatchery and the *modus operandi* have been designed on the basis of characteristic behaviour of larvae of these carps. The jars have similarity to the zoug jar used in Switzerland (Huet 1970).

A brief description of the hatchery, its mode of operation, commercial utility and some observations have been presented in the paper.

DESCRIPTION OF THE HATCHERY

The main components of the Hatchery are the installations for water supply, Breeding tank, Incubation and Hatching apparatus and Spawnerly.

SCALE 1cm = 24cm

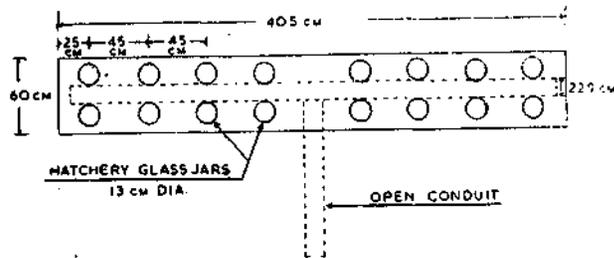


FIG. 1 (a). Detailed plan of hatchery.

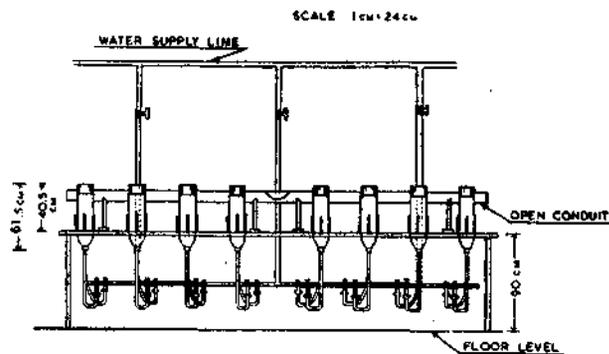


FIG. 1(b). Elevational view of the hatchery.

Water installation

The installation consists of 3 overhead tanks, 5 HP pump set and a freshwater pond to serve as water source. From the pond water is pumped in and stored in the overhead tanks which are placed on a brick tower about 4m high (Fig. 3). These tanks are connected to a pipe line which ensures supply of water at required pressure for circulation in the hatchery. Galvanised iron pipes of diameters varying from 2.5 to 7.6 cm have been used in the hatchery for supply of water. The total capacity of the overhead storage tanks is 5500 litres. Depending on the number of jars employed, the frequency of pumping water from the pond will have to be altered.

Breeding tanks

Normally, Breeding hapas (square-meshed mosquito netting) are fixed in ponds and the injected breeders are released in these for spawning. After spawning the developing eggs are collected and masured quantity of eggs are then released in hatchery jars for incubation and hatching. Sometimes however, the cement cisterns (1.8 x 0.9 x 0.9) inside the hatchery are used as breeding tanks.

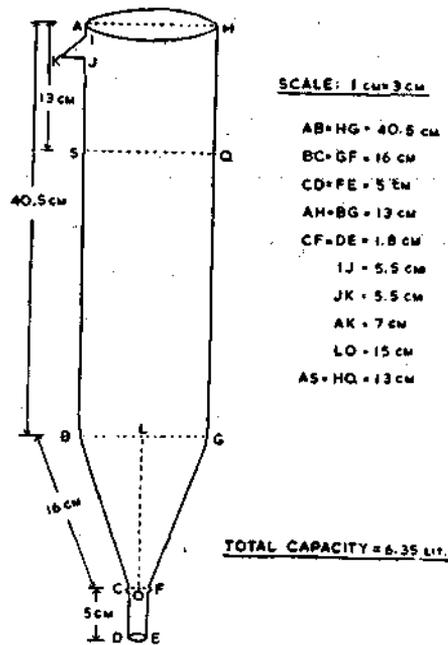


FIG. 2. Hatching Jar.

A breeding hapa is fixed inside a cistern and the injected breeders are released there for breeding. Each breeding tank is provided with an overhead shower for spraying freshwater.

Incubation and hatching apparatus

This unit consists of a battery of cone shaped glass jars, a series of taps, rubber tubing for linking the jars with taps, wooden rectangular table with circular holes fitted with clamps and open conduit (Galvanised iron) (Fig. 1 b).

The glass jars (6.35 litres) are set up vertically in the circular hole in the wooden table which is 0.9 m high and 0.6 m broad. Three fixed clamps around a hole keep each jar in a vertical position. The jars are fitted in two rows at intervals of 22.9 cm. The jars (Fig. 1 b) are, open at the top and gradually tapering towards the bottom. The maximum inner diameter of the jar is 13 cm and the minimum diameter at the tapering end is 1.27 cm (Outer). (Fig. 2). The top of the jar is fitted with a ring (Galvanised iron) having a spout which serves as the outlet. The jars are linked with rubber tubing with respective taps at the bottom of the table (Fig. 1 b). A jar holds 6.35 litres of water and can accommodate about 50,000 swollen eggs of major carps (catla, rohu, mrigal, silver carp and grass carp). Since the eggs of calbasu are smaller in size, about 75000 can be released in each jar. Semicircular conduit covering the spouts are fitted in such a way that the out-flowing water from each jar

falls into conduit leading to the spawnery. The conduit are supported on wooden stands with a slight incline so that water flows into the spawnery. The water is supplied from the taps through the bottom of the jars. The taps receive the required supply and pressure of water from the overhead storage tank.



FIG. 3. Sectional view of hatchery.

Spawnery

The spawnery consists of a cement cistern (1.8 x 0.9 x 0.9 m), Nylon *hapa* (close-mesh) 1.65 x 0.8 x 1.0 m) and the overhead shower (Fig. 3). The Nylon *hapa* is fitted in a frame and fixed inside the cement cistern. After hatching, the larvae come out of the jar along with the flow of water and collect in the spawnery. The spawnery is provided with an overhead shower for spraying freshwater to the hatchlings. The height of the spawnery (Nylon *hapa*) is kept slightly above that of the cistern so that overflowing water can pass through easily without disturbing the hatchlings (Fig. 4).

OPERATIONAL TECHNIQUE

The hatchery (Fig. 4) at Cuttack, consists of 40 jars with a capacity to accommodate 20 lakh (2 million) eggs at the rate of 50,000 in each jar, for incubation and hatching at a time. The two spawneries can accommodate spawn produced from 20 lakhs of eggs.

The Indian and exotic carps are induced to spawn by pituitary hormone injections. The indigenous carps breed inside hapas fixed either in ponds or in

the breeding tank in hatchery. The eggs of exotic carps are obtained by stripping since they normally do not release eggs in hapa. After water hardening, the eggs are removed from the breeding hapa, sampled and percentage of fertilization is determined. Measured quantity of eggs are then released very gently into the hatching jars. Usually 50,000 eggs are liberated in each jar. During incubation the flow of water in the jars is regulated to ensure that the eggs are stirred up gently without being split. The eggs are buoyed up and the flow is so regulated that when the eggs ascend half to two third of the height of the jars, they start dropping to the bottom from where they are carried up again by the current and the circuit is repeated. 600 ml to 800 ml/minute flow of water is sufficient for keeping the eggs circulating. The specific gravity of silver carp eggs being slightly higher than that of Indian carps, 600-1000 ml/minute water flow is needed for the former. The rate of flow may be slightly increased after the completion of hatching so as to expedite escape of the hatchlings from the jars. Since the newly hatched hatchlings have the habit of vertical upward movement they come to the water surface and pass out through the outlet along with the flow of water leading to the spawnery. Bad eggs, egg shells, abnormal and dead hatchlings are left behind in the jars which are subsequently removed by disconnecting the jars from the tap. In the spawnery, water is sprayed continuously for about 3 days until the fry are ready for stocking.

SOME OBSERVATIONS

It has been observed during 1970-73 that the percentage of hatching and survival of spawn of Indian and exotic carps in the hatchery complex are superior to that of cloth *hapas* fixed in stagnant ponds. In field conditions, certain factors which are beyond control, cause mortality of the developing eggs and hatchlings in hapas. Usually, the sudden rise of water temperature, appearance of algal

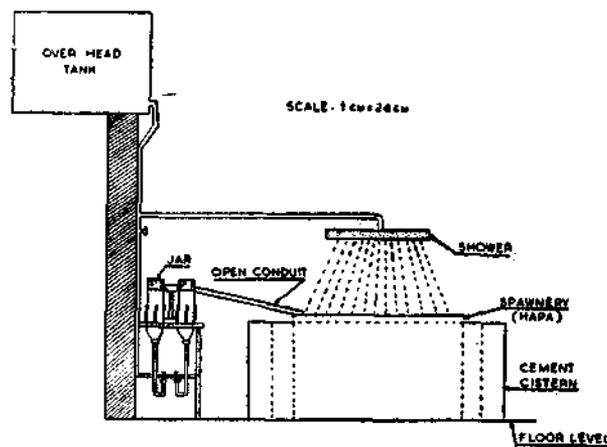


FIG. 4. The Hatchery at Cuttack.

bloom in ponds, entry of silt-laden water (after heavy rains), oxygen depletion, presence of some predatory fishes like *Tilapia*, *Ambassis*, etc. and common carp in ponds are responsible for large-scale damage of eggs and hatchlings under field conditions. High mortality of developing eggs and larvae are very often encountered in *hapas* especially when percentage of fertilization is poor. Once the mortality in *hapas* begins either in developing eggs or after hatching, it ends up ultimately in poor yield.

By the installation of the hatchery complex, majority of the above hazards have been eliminated.

In the hatchery even at water temperatures fluctuating within a range of 5°C, hatching and survival of spawn were observed to be satisfactory since running water kept the eggs in constant movement and maintained the optimum conditions required. The presence of large numbers of bad eggs in the hatchery jars also had no harmful effect on the yield. The healthy hatchlings do not come in contact with the dead eggs, egg shells and dead hatchlings because, due to their characteristic vertical movement, they pass out of the jar with the flow of water and collect in the spawnery. The bad eggs and egg shells are left behind in the hatchery jars. This is not so in *hapas* where the bad eggs and the good ones remain in close proximity for about 18-20 h which contaminate the good ones especially during adverse field conditions. In experiments with eggs of silver carp, catla, rohu, mrigal and calbasu, it has been observed that when the percentage of fertilization was poor, the yield of spawn from the good eggs in hatchery was far superior to those of the controls in *hapas* fixed in ponds.

Experiments with silver carp eggs, which repeatedly gave poor results in *hapas* fixed in ponds and rivers, showed far better percentage of hatching in the hatchery. Better survival in the Hatchery might be attributed to the supply of running water which kept the eggs rolling in the glass jars and provision of overhead showers in the spawneries which enriched the water with oxygen.

Since the eggs of common carp are adhesive they stick together and to the glass. So it becomes difficult to use the Glass jar Hatchery for incubation and hatching of these eggs. The problem has been overcome by treating these eggs with NaCl, Urea and tannin (Woynarovich 1969) which removed adhesiveness successfully without any adverse effect. Eggs of common carp thus degummed were incubated and hatched in the Hatchery successfully.

COMMERCIAL UTILITY

During 1973 and 1974, in 23 experiments, about 85 lakhs of seed fish mainly of major carps, chinese carps, common carp and carp hybrids, were raised in this small Hatchery Unit of jars. The price of these 85 lakhs of spawn at official rate (Rs. 120/- per/lakh) comes to Rs. 10,200-00, but if sold in the

open market it would fetch more. The production cost in the Hatchery on the other hand, was found to be negligible as against the cost in the Hapa Hatchery.

A hatchery consisting of 100 jars (which may be termed as a Hatchery Unit) with a capacity to handle 50 lakhs of eggs at a time can work like a factory producing fish seed on commercial scale. In view of the acute shortage of pure seed fish in the country, the establishment of hatcheries on the basis of small-scale industries will augment seed production and go a long way in solving the need of stocking material in India.

PHYSICO-CHEMICAL CONDITION OF WATER

Both pond water and tube-well water can successfully be used in the Hatchery. Dissolved oxygen in pond water varied from 4.0 ppm-8.0 ppm and in the tube well water from 3.0 ppm-6.9 ppm. The content of free carbon dioxide in tube well water was more but due to the spraying the same was reduced and as such no lethal effect was observed.

Water temperature in the Hatchery varied normally from 29.5°C to 33.5 during the period of operation. Temperature was always less by 2/3°C in the spawnery due to the spraying of water.

Temperature of tube-well water was mostly less than that of pond water.

Estimated quality of water required to run the hatchery for 15 hours

Rate of flow of water in the jar : 600-800 ml per/minute.

(for major carps).

Therefore, one jar in an hour required 48 litres.

Hence 40 jars in an hour required = $40 \times 48 = 1920$ litres.

The water supply may continue for about 15 h, so that all the hatchlings can pass out. Thus, total quantity of water needed for 15h = 1920 litres x 15 = 28,800 litres. Usually eggs are transferred to the jars 6-8 h after spawning.

In addition, showers are provided in the 'spawnery' for 3 days.

Total capacity of the overhead tanks = 5500 litres.

Appendix - 1. Particulars of the Hatchery

1. Capacity of each jar — 6.35 litres.
2. Total length of th jar — 61.5 cm.
3. Inner diameter — 13.0 cm.
4. Cost of each jar (Pryc glass) — Rs. 200/- or above.
5. 50,000 eggs can be released in each jar at a time.

6. In a Hatchery consisting of 40 jars 20 lakhs of eggs can be handled at a time.
7. In two spawneries hatchlings obtained from 20 lakhs of eggs can be accommodated for 3 days.
8. The size of the spawnery — 1.65 x 0.8 x 1.0 m.
9. The size of the cement cistern — 1.8 x 0.9 x 0.9 m.
10. K. I. conduit covering all the jars.
11. Shower for spraying water in the spawnery.
12. Capacity of the over head tanks (3) 5500 litres.
13. 5 H.P. pump set.
14. The wooden table with circular holes.
15. Clamps for fixing the jars (3 nos for each)
16. Rubber tubing (1.27 cm inner diameter).

Advantages over hapa hatchery

1. Once a hatchery is established it can last for years.
2. Recurring expenditure on *hapa* is almost 'nil.'
3. Mortality of hatchlings during various stages of development due to fluctuating water temperature, predation, oxygen depletion, algal bloom, crab menace and other unforeseen hazards can be controlled.
4. Bad eggs and the egg shells cannot pass out of the jars along with hatchlings. Thus, any chance of mortality due to oxygen depletion in the spawnery or probable infection from the rotting egg shells is eliminated. This is not possible in the *Hapa* system.
5. Since running water is supplied, the chance of water pollution and oxygen depletion is avoided.
6. Recurring expenditures on bamboo poles, cotton ropes etc. and the labour for fixing *hapas* are saved.
7. Dead eggs, hatchlings and deformed larvae are automatically segregated from the good ones.
8. Irrespective of rain and sun the work can be done with ease under roof.
9. The hatchery can be established in any place near a fish farm.
10. Operation of the hatchery is so easy and simple that it can be operated by any non-technical man.
11. Once eggs are released in the jars much of the work is over because after hatching, the larvae will be mechanically carried into the spawnery.
12. Over 90% hatching success and survival of spawn are usually achieved

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