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A Simple Self-Contained Incubator for Cichlid Eggs

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Abstract.—This report describes a simplified, low-cost method for artificially incubating eggs of mouth-brooding tilapia *Oreochromis* spp. The complete incubator consists of an aquarium and a core element that agitates the eggs with a low-head airlift pump. This technique was flexible and simple in design and construction. In addition, the technique was self-contained and in most circumstances required only a source of compressed air to function. Using a 0.3-L egg chamber within a 38-L aquarium, up to 1,000 tilapia eggs were successfully reared to swim-up fry with minimal losses (5–10%). A commercial test using a 95-L reservoir and multiple cores consistently produced batches exceeding 15,000 fry. This technique is suited for both commercial hatchery and middle school through college laboratory use.

An inexpensive, small-scale hatching jar could be useful for commercially incubating multiple batches of eggs from mouth-brooding tilapia *Oreochromis* spp. In addition, observing developing fish eggs can be a learning tool for high school and college science classes as well as research laboratory use. There have been a number of devices developed that are suitable for this purpose. For example, Glenn and Tiersch (1997) modified plastic soft drink bottles as hatching chambers. Other incubating systems are described by Rothbard and Hulata (1980), Dewey and Wagner (1993), and MacIntosh and Little (1995).

In 1993, I published a simplified incubation technique potentially suitable for classroom use (Brooks 1994). In this design, falling water was used to churn eggs suspended in a fry net. Water was supplied by an airlift pump, but eggs frequently were trapped in folds of the netting. Small changes in water level could also affect the survival of the eggs by changing the pumping rate of the airlift or leaving the eggs out of water. Consequently, the level of care necessary to incubate the eggs and sac fry was greater than anticipated.

The following improved incubation technique was developed to overcome the difficulties in the earlier design. It fulfilled the need for a simple, self-contained, low-cost, low-maintenance incubator for tilapia eggs and fry.

The complete incubator included a 38-L reservoir, an airlift pump constructed from a 12.7-mm polyvinyl chloride pipe, and an egg chamber (Figure 1). The egg chamber was a submerged, cylindrical container with a hemispherical bottom (drinking glass), resting on the floor of the reservoir. The egg chamber, which was transparent to aid in observing egg development, held 0.24–0.5 L of water, depending on the number of eggs to be hatched.

The airlift pump consists of a base, airlift pipe, primary air release pipe, secondary air release pipe, water transfer pipe, and agitator pipe (the airlift and agitator pipes were 20.4 cm and all other pipes were 10.2 cm; Figure 1). The two 90-degree elbow and three "T" connectors used were all compression fittings requiring no glue or cement.

Air is injected into the airlift pipe by means of an airline and provides the energy to move water, which enters through the exposed ends of the base. A 5-mm hole drilled at the base of the airlift pipe above the connector accommodates a drip irrigation nipple attached to an air supply. Alternatively, air can be supplied through a pipette via the primary air release pipe. Water enters the device through the core water intakes.

As the injected air is released through the primary air release pipe, gravity forces the lifted water through the water transfer pipe into the agitator pipe. Excess air was released through the secondary air release pipe. The water transfer pipe must be submerged at all times, and the air release pipes must extend above the surface of the water or the airlift pumping action will be lost.

Water exiting the bottom of the agitator pipe is deflected upward by the curved bottom of the egg chamber, thus gently churning the fish eggs. The volume of water pushed through the agitator pipe depends on the amount of air injected into the airlift pump. A gang valve regulates airflow. Only a small flow was needed to gently move all of the eggs.

A 0.27-L egg chamber was used in the tests.

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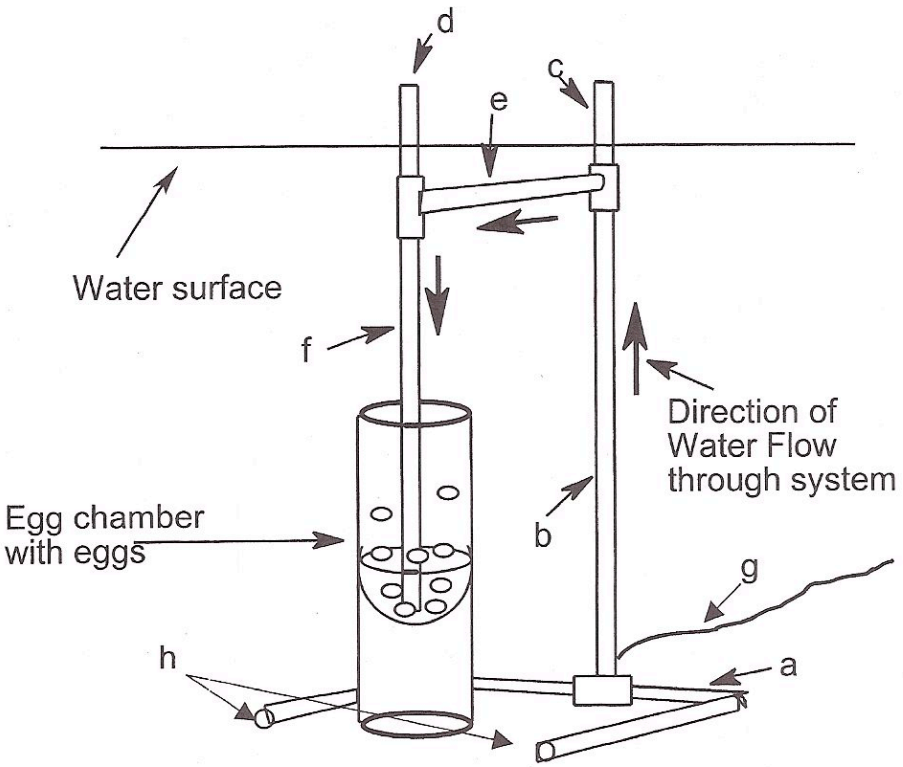

FIGURE 1.—Incubator core diagram of the experimental incubating system for tilapia eggs and fry, showing the base (a), airlift pipe (b), primary air release pipe (c), secondary air release pipe (d), water transfer pipe (e), agitator pipe (f), air line (g), and core water intakes (h).

Though fragile, egg chambers made of glass were inexpensive, easy to clean and heavy enough to stay in place on the tank bottom. Once the eggs hatched, the tilapia fry remained in the chamber until reaching the swim-up stage.

Construction costs were minimal requiring US$3.00 for the materials for a single core and egg chamber and $10 for the aquarium. Additional infrastructure costs of $15.00 included an air pump, gang valve, and air tubing. Because no glue or cement was necessary, construction time was also minimal (15 min). The installation of a tank divider allowed two cores to be used.

Using the described incubator, single batches of 1,000 hybrid eggs (female Mozambique tilapia *O. mossambicus* × male golden tilapia *O. hornorum* or blue tilapia *O. aureus* × Nile tilapia *O. niloticus*) were successfully hatched and reared to swim-up fry with minimal losses (5–10%). Dead eggs tended to turn white, change density, and float out of the egg chamber. No fungicides were used and no fungus growths developed on living eggs.

Cores can be constructed singly or in interconnected banks of more than one unit. The size of the reservoir will vary with the number of cores used, and the number of eggs to be incubated. Eggs can be loaded through the secondary air release pipe into the egg chamber with a funnel and water.

Filter socks can be placed over the water intakes on the base. Temperature can be controlled with aquarium heaters. If multiple cores are used within a single reservoir, I recommend the eggs in each egg chamber be approximately the same age; otherwise, fry hatched earlier may enter neighboring egg chambers and cannibalize eggs and fry.

Incubator cores may be placed in any tank having appropriate water depth and air supply. This allows the user a considerable degree of flexibility in how and when the technique is applied. For example, using a 95-L aquarium and multiple cores with 0.47-L egg chambers, 15,000 eggs in multiple batches were simultaneously incubated.

This technique is self-contained, flexible, and simple in design and construction and requires only a source of compressed air to function. All components were readily available from local hardware, grocery and pet stores. Setup time is minimal. Our tests suggest the technique may be

used to hatch sufficient numbers of eggs to meet various needs.

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