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FLOW RATES CONTROL FUNGAL INFECTIONS OF RAINBOW TROUT EGGS

Hatchery personnel have used many chemicals to control disease outbreaks on fish eggs. The number of chemicals presently permitted for use with eggs has dwindled to three: hydrogen peroxide, salt, and formalin. Chemical treatments can be expensive to apply and toxic to sensitive fish species. The growing aquaculture industry, dependent on the production of healthy fish eggs, needs additional cultural methods.

Elevated flow rates to roll eggs in hatching-jar systems seems to reduce the incidence of fungal infections. Green eggs can be highly sensitive, however, and vigorous rolling may induce death. We tested various flow rates for controlling fungal infections and improving egg survival in a hatching jar system by using both uninfected rainbow trout (*Oncorhynchus mykiss*) eggs and eggs artificially infected with fungus (*Saprolegnia parasitica*).

EGG HATCHING JARS WERE USED TO EVALUATE TREATMENTS

Green eggs were obtained from Trout Lodge (Sumner, Washington) and shipped to the National Fisheries Research Center, La Crosse, Wisconsin. Eggs were received within 36 h of spawning, acclimated to $12 \pm 1^\circ\text{C}$, and 30 mL (about 300 eggs) of eggs were transferred into each miniature egg hatching jar (5 cm in diameter; 15 cm long).

The egg hatching system was composed of a headbox, miniature egg hatching jars, and glass aquaria. Continuously flowing well water at $12 \pm 1^\circ\text{C}$ entered the headbox and flowed by gravity to the egg jars. The effluent from the egg jars then flowed into glass aquaria that collected hatched fry from the jars.

Two separate trials were conducted. Uninfected eggs (trial 1) were compared with eggs artificially infected (inoculated) with fungus (trial 2) in tests that exposed eggs to variable flow rates of 300, 600, 1,200, and 1,800 mL/min. Each flow rate was tested in triplicate. Comparisons ($P \leq 0.05$) of percent hatch at different flow rates were made by analysis of variance with Student-Newman-Keuls test for type I experimental error.

ROLLING OF EGGS INHIBITED FUNGUS

The four flow rates were selected to achieve a range of egg movement. Eggs cultured in the 300-mL/minute flow showed no movement, whereas eggs in the 600-mL/minute flow displayed slight movement but did not roll. Eggs in the 1,200-mL/minute flow were raised in the water column and exhibited a slight to moderate rolling action. Eggs in the 1,800-mL/minute flow were elevated higher in the water column and rolled vigorously.

In trial 1, the egg hatching success in the three lower flows (300, 600, and 1,200 mL/minute) were not

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significantly different and average hatches were 85.4, 83.1, and 82.2% (Figure). Because the incidence of naturally occurring fungus is generally low in eggs cultured in the Center's well water supply, fungal infections did not develop at any of the flow rates. However, only 20.2% of the eggs hatched at the 1,800-mL/minute flow, presumably because of the excess agitation.

The procedure used to infect eggs with fungus (trial 2) resulted in the infection of eggs at the 300 and 600-mL/minute flows and the hatch rates in these flows were less than 10%. At the 1,800-mL/minute flow rate, the hatch rate was only 25%. Although most of the eggs at this flow were dead within the first week of testing, there was no observed fungal infection. The 1,200-mL/minute flow was the optimum flow with a mean hatch rate of 78%, which was significantly ($P \leq 0.05$) higher than the hatch rates at the other flows. This flow was high enough to control the fungus without causing death of eggs.

MANAGEMENT IMPLICATIONS

The rolling of fish eggs is useful in controlling fungus on eggs. Its effectiveness for hatchery use is dependent on

the ability of culturists to observe egg movement and adjust flows to generate the appropriate movement of the eggs. However, physical manipulation of eggs does not eliminate the need for chemical treatments. Raising salmonids in stacks of Heath incubators requires chemical treatments for fungal control. Hatcheries that use surface water for culturing eggs usually have a higher incidence of fungal infestations. Eggs being shipped between hatcheries are vulnerable to stress and rapidly spreading fungal infections. A combination of chemical treatment and physical manipulation would probably be needed in most hatcheries.

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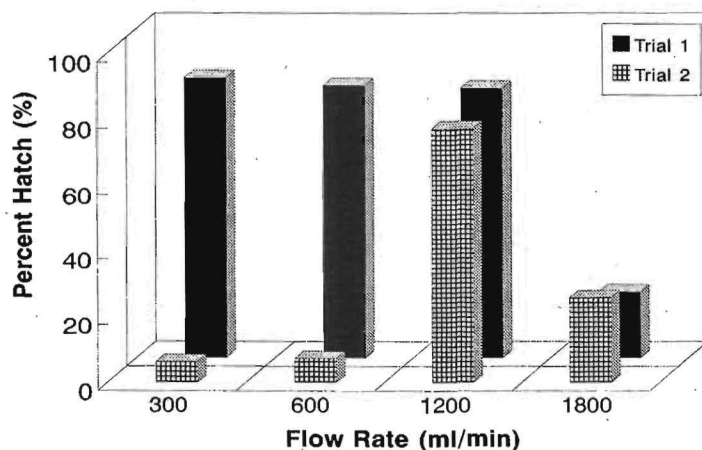


Figure. Comparison of hatch rates of uninfected (trial 1) and fungal infected (trial 2) rainbow trout eggs cultured at different flow rates.