The Hatching of Brine Shrimp

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INTRODUCTION

The purpose of this report was twofold: (1) to gain experience in setting up experiments and evaluating information concerning the storing and hatching of brine shrimp eggs and (2) to add to the scanty information available concerning the hatching of brine shrimp for tropical fish food. Brine shrimp were chosen because they are easy to work with, inexpensive, and readily available. Ott (1962) performed several experiments with brine shrimp. Other information was from Gannon (1960, 1961), who devised certain basic techniques used in setting up experiments with temperature.

MATERIALS AND METHODS

The apparatus included three glasses, three rectangular glass pans, three quart jars, a thermometer, a measuring cup, three small tin cans, a string of Christmas lights, and brine shrimp eggs. All sets of experiments (Table I) were performed under identical conditions with the exception of the one variable.

To test the effects of temperature, a given quantity of salt solution was put into each of the three rectangular glass pans. The salt solution consisted of one cup of coarse salt, one tablespoon of Epsom salts, and one-half teaspoon of baking soda to 1 gal of water. This salt solution was used in most of the experiments. Temperature control was effected by floating the tin cans in the salt solutions and then placing lights inside the cans. By adjusting the depth to which the can sank in the water, a constant temperature of 63, 75, or 90 F could be maintained. In the 63 F water the shrimp hatched after 5 days, 2 hr. They were very few in number and were inactive. The shrimp in the 90 F and 75 F water hatched slightly under 22 hr after being placed in the solution. Both lots hatched well and the shrimp were active, although the hatch in 90 F water was slightly less. The time given for each hatch is approximated to the nearest hour from which I first observed the swimming shrimp in the solution. The shrimp continued to hatch for the next 24 to 48 hrs.

The next experiment involved light and dark. Both hatchings were normal and the shrimp were active. The shrimp hatched in 24 hr. The light source used was a 60-watt bulb standing one yard from the pan. After hatching, the shrimp were attracted by the light.

In the next experiment, one set of eggs was quick frozen for 5 min. Other eggs were placed in water and held in the steam of boiling water for 5 min. The hatch of the frozen eggs was good, and the shrimp were active. They hatched in 23 hr. No shrimp hatched from the steamed eggs. All experiments were compared with controls.

The eggs for experiment four were frozen slowly and kept frozen for 24 hr. The hatch, after 23 hr was fair and the shrimp were active.

Experiment five deals with acids and bases. To group one, lemon juice was added to make it slightly acid. To another, baking soda was added to make it slightly basic. Red and blue litmus paper were used to test each group. Although the acid-treated eggs did hatch, the hatch was poor and the shrimp inactive. The basic hatch was fair and the shrimp active. The hatching time for the acid group was 28 hr and for the basic group, 24 hr.

In experiment six, one solution was made medium acid with lemon juice and the other medium basic with baking soda. The acid hatch was very poor and the shrimp were inactive. The basic hatch was good and the shrimp were active. The hatching times were 31 hr for the acid group and 22 hr for the basic group.

Experiment seven concerned water depth. In one open glass, water was filled to the depth of one inch. The second and third glasses contained water 2½ and 4 inches deep respectively. The 1-inch jar had an excellent hatch and the shrimp were very active. The hatching time of 19 hr was 2 hr less than any of the other groups. The hatch of the 2½-inch glass was good and the shrimp active. The hatch of the 4-inch jar was fair and the shrimp were active. The hatching times for the second and third jars were 23 hr and 24 hr respectively.

The next experiment involved closed jars 4¼ inches tall. Jar one was filled with 1 inch of water and closed. Jar two was filled with 4 inches of water and also closed. The hatch of jar one was excellent and the shrimp were very active. The hatch of jar two was poor but the shrimp were active. The hatching times for jars one and two were 21 hr and 25 hr respectively.

In experiment nine, two wires were run into the water, one on either side of the pan. The other ends were connected to a 9-volt battery for 1 min. No shrimp hatched.

In experiment ten, 7-year-old eggs were used. No shrimp hatched. The above information is summarized in Table I. Each hatch is compared to the control group and is related accordingly.

TABLE I. EXPERIMENTAL RESULTS IN HATCHING, HATCHING TIME AND AGILITY. VARIABLE CONDITIONS, LEFT COLUMN. A DASH INDICATES NONE, PLUS (+) OR MINUS (—) SIGNS INDICATE DEGREES OF HATCHABILITY OR AGILITY.

	Hatching success	Hatching time in hours	Agility
Temperature F			
63	— — —	122	———
75	— — —	22	+
90	++	22	+
After extreme temperature			
treatment, quick frozen	++	23	+
Slow freeze	+	23	+
Steamed	——	——	———
Light	+	24	+
Dark	+	24	+
Combination	+	24	+
Acids and Bases			
Slightly Acid (lemon juice)	—	28	———
More Acidic (lemon juice)	— —	31	———
Slightly Basic (Na HCo_3)	+	24	+
More basic (Na HCo_3)	++	22	+
Water depth in inches (open jars)			
1	+++	19	+
2½	++	23	+
4	+	24	+
Water depth in inches (closed jars)			
1	+++	21	+++
4	—	25	+
Electricity	——	——	———
Age of eggs (yr)			
7	——	——	———
Control	+	24	+

DISCUSSION

The temperature experiment clearly showed that brine shrimp hatch best in water ranging from 75 to 90 F. However, the 90- degree temperature is not feasible because of the high evaporation rate and the difficulty in maintaining the temperature. It is important to note also that even at 63 degrees, a few shrimp did hatch.

From experiment two it can be concluded that shrimp can be hatched in either light or dark with good results. However, it was observed that the shrimp are phototropic.

Experiments three and four showed that the eggs are injured by high temperatures but not by freezing. It may be that the outer coat is thick enough to protect it from freezing, or possibly and most logically, the embryo remains dormant like a seed until the conditions are favorable for growth.

Previous information stated that acids were highly harmful to the hatching shrimp even to the point of no hatch. It also indicated that a mildly basic solution could be harmful. Results show that the acid, although harmful is not as destructive as the previous information indicated. The basic solution actually improved the hatch and the activity of the shrimp. Therefore, a basic solution is probably beneficial to development.

The depth experiments resulted almost as expected. Both hatches in the shallow containers proved the best. As the water deepened the number of hatching shrimp decreased. A possible explanation is that the oxygen content of the shallower dish is greater than in the deeper vessels. One thing not understood, however, is why the hatch in the closed shallow jar excelled that of the open shallow dish.

Perhaps shrimp eggs have high electrical conductivity, since they were destroyed by electricity. Possibly the electric charge causes the formation of chemicals or ions which are unfavorable for the hatching of brine shrimp.

Eggs up to 4 years old have been known to hatch, but eggs known to be at least 7 years old did not hatch. This means that like seeds, the embryonic cells lose their ability to develop after a given period of time, somewhere between 4 and 7 years.

CONCLUSIONS

It was found that brine shrimp can be hatched with best results when using a mildly basic salt solution maintained at a temperature of approximately 75 F. The shrimp prefer light after they hatch, but it is not necessary for the hatch itself. Freezing for short periods of time does not produce noticeable harmful effects. The shrimp hatch best in shallow water. An electrical shock is deadly to shrimp eggs, and eggs over 4 years old cannot be expected to hatch.

Further work could be done on the effects of long-term freezing of brine shrimp eggs. Other work could be done in the development of a technique to raise the brine shrimp to adults. The percentage reaching maturity in captivity is extremely small.

The experimental results could greatly improve the feasibility of hatching brine shrimp to meet the increasing demand for them as tropical fish food. Most shrimp sold today are frozen but now one could set up a simple apparatus and hatch his own at an economical rate and with a fair degree of success.

LITERATURE CITED

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